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India, like many developing nations, must soon make a decision about satellite television. National integration, upgrading and extending education, strengthening the vocational and technical components of education, modernizing agriculture, family planning, teaching literacy--the stated goals of the Indian government--could be more easily achieved with a national television network. Capital investment and operating costs for such a program are high; less expensive alternatives should be considered. An adequate technical and personnel base would be necessary for reliable service--which means training programs and industrial modernization if the country is not to be dependent on outside help. A department must be established to control and organize the program. If satellite television is to be employed, the problems of access to satellite technology, coverage area and spillover, and heterogeneity of the viewing audience must be solved. It is probable that, in the case of India, the best way to provide an economical, reliable, national network, with service to the villages, is to move gradually in the direction of a system employing direct television broadcast from a satellite. Appendices include data about Indian demography, education and information systems, and present plans for television. An annotated bibliography is included. (JY)

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COMMUNICATION SATELLITES FOR EDUCATION AND DEVELOPMENT – THE CASE FOR INDIA

Prepared for:

U.S. AGENCY FOR INTERNATIONAL DEVELOPMENT

by

WILBUR SCHRAMM AND LYLE NELSON
STANFORD UNIVERSITY

AUGUST 1968

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August 1968

Volume II

COMMUNICATION SATELLITES FOR EDUCATION AND DEVELOPMENT — THE CASE OF INDIA

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WASHINGTON, D.C.

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By: WILBUR SCHRAMM and LYLE NELSON

SRI Project 7150

Communication Satellites for Education and Development -- The Case of India

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PREFACE

In March 1968, the U.S. Agency for International Development, in support of the President's Task Force on Communications Policy, contracted with Stanford Research Institute to study educational applications of communication satellites for developing countries. The study was designed to determine the potential of satellite-delivered educational broadcasts through analyses of two developing regions. A single large nation, India, and a multinational region, Latin America, were chosen as case studies to illustrate the scope of possible applications. The emphasis of the case studies was to be on the educational, economic, cultural, organizational, and political factors affecting the feasibility and utility of satellite communication.

This report deals with India. Volumes in the project series include:

Volume I:	Satellite-Distributed Educational Television for Developing Countries--Summary
Volume II:	Communication Satellites for Education and Development--The Case of India
Volume III:	Satellite-Distributed Educational Television for Developing Countries--The Case of Latin America

Volume IV: Satellite-Distributed Educational Television for Developing Countries--Working Papers

1. Nonhardware Components of an Instructional Television System for a Developing Country
2. Considerations in Deciding Whether and How to Introduce an Educational Satellite
3. Film Versus Television in Education
4. Technical Considerations of Satellite Communication Systems for Education
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I THE PURPOSE OF THIS REPORT

The possibility of using a communication satellite to deliver television throughout the nation, in support of education and national development, is being considered seriously in India.

In particular, two plans for pilot projects are being discussed in the press and in the government. One of these is a joint activity of the Indian National Committee on Space Research (INCOSPAR), and the U.S. National Aeronautics and Space Administration (NASA). Counterpart teams from these two organizations have met several times with the stated intention of preparing a proposal for experimental use of one of the later ATS satellite series (probably the F or G) to be launched by NASA about 1970. The project has not been officially decided upon, but preliminary papers have discussed a pilot project of one year's duration, during which the satellite would be moved to an appropriate equatorial position to serve India. The existing Ahmedabad satellite earth station would be upgraded to make television programs and transmit them to the satellite. The existing VHF station in Delhi, and two new VHF stations (one in a rural area near Ahmedabad, one at a location not yet selected) would be fitted with large dish antennas to receive signals from the satellite and rebroadcast them to approximately 3,000 new receivers, as well as to existing receivers in the Delhi area. At the same time, direct broadcasts from the satellite would be received on 2,000 smaller dish antennas equipped with suitably augmented receivers, outside the range of normal ground-based transmitters in schools and villages. Thus, the project would test the proposed hardware for direct broadcasting and redistribution satellites, and would identify many of the problems involved in programming and administering such a service. Unofficially, the capital cost has been estimated at $6.6 million, of which only about $4.2 million would be out-of-pocket expenditures, inasmuch as existing facilities at Ahmedabad and Delhi could be used.

A second plan, much publicized in recent months, was presented in the report of a Unesco Expert Mission which visited India in November and December of 1967. They proposed a "pilot" project, but only in the sense that it would try out new technology and methods. The project would not be limited in time, but would be assumed to go on as long as the satellite worked (probably 5 to 10 years). The plan provided for two satellite earth stations (Ahmedabad and Delhi) with programming facilities, four rebroadcast stations (Bombay, Calcutta, Madras, and Kanpur), and 50,000 receivers, 15,000 of which would be specially equipped to receive signals directly from the satellite. Capital investment, including satellite development, procurement, and launching costs, was estimated to be in the neighborhood of $50 million.

In addition to these plans, there have been, within the last three years, three studies at American universities concerned with the design and use of a satellite system for India, although these studies were without the benefit of field work in India itself. A member of the staff of INCOSPAR has made cost estimates of alternative methods of delivering television to all of India: by ground-based transmitters linked by microwave, by ground stations linked by satellite, by a combination of rebroadcast and direct broadcast from the satellite to receivers, and entirely by direct broadcast. At least three provisional system designs have been submitted by U.S. space industries -- Hughes, General Electric, and Westinghouse International -- and the Communication Satellite Corporation has studied the requirements and possibilities of providing educational television by satellite to several areas of the world, including India. All these studies and proposals are listed and summarized in Annex 2 of this report.

It is safe to say that no other developing country on earth has had so much attention with respect to its potential use of a television satellite. This is because it offers both extraordinary challenge and potential. Three quarters of its half billion people are illiterate; and four fifths of the people live in small villages, half of which are not even reached by roads. The possibility that has stirred the imagination of so many people is that of being able to leap the formidable barriers of illiteracy, remoteness, and inefficient or nonexistent communication, and speed the people of India along the road to development.

India will make up its own mind on the various satellite plans and proposals before it, and decide whether or where a satellite belongs in its development plans. The purpose of this paper is not to suggest what India should do, but rather to consider the Indian situation as a case, worthy of consideration by other developing countries, by planners and policy makers in all countries who are concerned with the use of satellites, and by aid-granting agencies who may have to decide where to place support.

The basic question we shall try to answer in the following pages, therefore, is not whether India should make use of a satellite, but rather, what are some of the main considerations which any country (India being only a case in point) must take into account in making a decision about satellite television.

It will become apparent in the following pages that a very great many of these considerations will have to do with television itself, rather than satellites as a means of distribution. The extension of television over a very large area, without having to wait for the normal extension of conventional ground stations and microwave, is the chief potential that a satellite offers to developing countries. Therefore, the first question any such country must face, when considering a television satellite, is whether the massive use of television can contribute to economic and social development in a degree commensurate with its cost.

This consideration must necessarily begin with an estimate of what television can be expected to accomplish, as a medium of information and instruction, given the conditions under which it will have to work. We have discussed this question in Chapter II. A more basic question, however, is what the nation desires to do with television. The answer to this query must rest upon a review of national goals, and upon the identification of high-priority development tasks to which television could make a substantial contribution. If these do not exist, there is obviously no use thinking of wide expansion of television, with or without a satellite. We have taken up this problem, in terms of India, in Chapter III.

Supposing, however, that urgent needs for television can be identified, then what are the special considerations that must be taken into account in deciding whether to introduce a national television system, and whether to build a space link into it? This is the subject matter of Chapter IV. What resources must be committed? What technical and personnel base will be required? What decisions must be made about organization and control? What kind and amount of planning and preparation must go on before such a major system can be effectively activated? If the system is to include a satellite, these questions may be different in magnitude but not in kind. Certain other considerations, however, are characteristic of a satellite system. The most important one is the conflict between localness and globalness -- between the ability of the satellite to deliver the same signal over an enormous area, and the heterogeneity of local needs and capabilities within that area. India offers a challenge to the use of a satellite because it is a classical case in heterogeneity. Linguistically, culturally, educationally, it is more diverse than many continents. If India can find a useful function for a television satellite, in the face of all its heterogeneity, then almost any potential user should be able to do so.

Chapter V turns to the possible system designs which grow out of the examination of capabilities and needs, and the adoption considerations, of the preceding chapters. We have outlined a number of different configurations for Indian national television systems, most of them including a space link, and have estimated what they would cost to build and operate, how long they would take to develop, and what the coverage would be at a given point in time. We have also tried to point out some of the advantages and disadvantages of each.

Finally, in Chapter VI we have had something to say about the meaning of "feasibility" in making such a decision on satellite television, and about the significance of the Indian case for other countries facing such a decision.

Following these chapters we have placed some annexes containing basic material on the present communication system of India, the various plans and proposals for possible satellite systems in India, and other information which may be helpful to readers of these pages, but which we have thought should be put later where anyone interested can consult it without digressing from the main discussion.

Because so many questions about a television satellite have to do with television, however, it may be helpful, at this point, to say a few words about the present state of television in India, and the tentative official plans for expanding it. These plans were prepared, of course, before serious consideration was given to the possibility that a satellite might foreshorten the process.

Since 1959, as already noted, All India Radio has operated a small experimental television service in Delhi. Beginning with a few hundred receivers and a single studio, this service has been very slowly expanded until it now broadcasts a total of 21 hours a week, one half of the service to schools and the other half to teleclubs and an increasing number of home viewers. The total number of receivers is now somewhere between 6,000 and 7,000, most of which are in the city. Recently, receivers have been placed in 79 villages to observe the effectiveness of an agriculture program and other components of the general service which operates from 90 minutes to two hours each evening.

All India Radio proposes to develop ground-based television in three steps (Outline of Perspective Plans for the Expansion of Television in India, 1967). During the Fourth Five-Year Plan, which has been delayed and is now envisaged as extending from 1969 to 1974, four additional VHF stations would be established -- in Bombay, Madras, Calcutta, and Kanpur -- and the existing station in Delhi would be improved and expanded. The new stations, however, would have minimal facilities at first, with the total cost during the Fourth Plan projected at only 375 lakhs of rupees ($5 million).

The second step, to be undertaken as soon as possible after the first one but not during the Fourth Plan (i.e., not until after 1974), would further expand the facilities of these stations so that all of them except Kanpur would be what AIR designates as Type I stations, meaning that they would have four studios and be major production centers. Kanpur would be a Type II station (two studios). In this second step, eight additional Type I stations would be added, and also eleven Type III stations (one studio, and consequently restricted production capacity). There would also be 15 low-cost relay stations, with no studios. This plan would place a station in the capital city of each State and each federally administered territory. The total capital cost of this second phase has been estimated by AIR at about 80 crores of rupees ($107 million).

A later (third) phase would add 30 more Type III stations, and two Type II stations, at a capital cost of about 50 crores of rupees ($67 million). This would have the effect of providing television service for all of India's cities of over 200,000, and about half of those with 100,000 or over. It is worth noting that the plan is based upon covering the cities rather than maximum coverage of villages.

The most optimistic projection by AIR is that this development might be completed in 15 years, at a cost of an estimated $179 million, although to do so television would have to receive a higher priority in India's development plan than it now holds. Even so, at that time, the system would cover only about 19 per cent of the area, and 25 per cent of the population of India (estimated by AIR in An Informative Note on Educational Television in the Context of Satellite Communication, 1968, p. 11). The conclusion is therefore inevitable: Most of village India still would remain outside the television service. It also should be noted that the estimated costs do not include microwave connection or receivers. Extrapolating from Posts and Telegraphs estimates, it seems reasonable to assume that interconnection would add another $30 or $40 million. If only 2,000 receivers were provided for each one of the stations, that bill might run to an additional $35 million. In other words, the total investment, exclusive of operating costs, would be in the neighborhood of a quarter of a billion dollars.

It is this order of cost and this slow rate of expansion that has led both Indians and others to ask whether a communication satellite might be feasible and desirable within the Indian communication system.

THE EDUCATION AND INFORMATION SYSTEM OF INDIA: 1968

Education: 70 million children and young people in school -- 78 per cent of children of primary school age (grades 1 through 5), 32 per cent of middle school age (grades 6-8), 17 per cent of secondary school age (9-11), 2 per cent of university age. Two million teachers, about 27 per cent of them untrained. School expenditures average 9 dollars per pupil per year.

Literacy: 34.5 per cent for men, 13.0 for women; overall, 24.0 in 1961. Estimated at 28.6 in 1966. Between 1951 and 1961, percentage of illiterates declined, but population grew so fast that number of illiterates actually increased.

Newspapers: 601 dailies with total circulation of 6.3 million. 2,403 weeklies and 5,636 published less frequently, with total circulation of 15 million. Dailies published in 20 languages. Circulate predominantly in cities, and total circulation low because of low literacy.

Films: One of largest film industries in world. Average of 320 films a year, in many languages. Annual attendance, 1 billion. Every film house required to show government news or documentary with each feature film.

Radio: All India Radio, part of the Ministry of Information and Broadcasting, has 36 stations, 23 area centers, 26 light program centers, 90 medium wave and 31 short wave transmitters. Covers with medium wave about 52 per cent of area and 70 per cent of population of country. Estimated 8 million receiving sets. AIR spends about $11 million a year. Broadcasts 12 to 13 hours light program, 11 to 12 hours of home service daily. 44 per cent of program in average region is Indian classical music.

Television: Small television service has operated experimentally since 1959 from Delhi. Programs 21 hours a week, to schools, teleclubs, and 79 villages recently equipped with receivers. Estimated 6,000 to 7,000 receivers, mostly in city.

Telecommunications: 1,380 miles of microwave, and more under construction, but unable to carry television. 3,000 miles of coaxial cables, used largely for telephones, telegraph, teletype. Estimated about 2 telephones for every 1,000 people. In 1966-67, the Indian postal service handled nearly 6 billion articles, and 45 million telegrams were sent. Experimental satellite communication earth station operative near Ahmedabad. India belongs to Intelsat, and is building ground station to participate in that network.

Development field staffs: About 40,000 development workers, most of them assigned primarily to agriculture. Village level workers, assigned to 5 to 10 villages each, now serve about half of the country's 568,000 villages.

FOR DETAILS, SEE APPENDIX A.

II HOW EFFECTIVE IS TELEVISION?

Before considering the possible usefulness of television in India, and the advantages and disadvantages of delivering it by satellite, let us take up briefly a fundamental question: What evidence have we to indicate that television is likely to be at all effective in a national program of education and development?

There have now been upwards of 500 research papers on instructional television, and several hundred papers on instructional films which are done in such a way as to make their results largely applicable to television. In addition, there are about 30 case studies of major television projects. Most of these studies have been conducted in the industrialized countries -- indeed, the majority of them in the United States -- but about 10 per cent of the research comes from the developing countries of Asia, Latin America, Africa, and the South Pacific. Therefore, we have some basis for projecting relevant findings to India.*

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* The most nearly complete summary of the research on television as an instrument of education and development is Chu and Schramm, Learning from Television (Stanford, 1967). This volume also lists most of the existing bibliographies and summaries of research in the field. The largest collection of case studies is the three volumes entitled The New Media in Action: Case Studies for Planners (Paris: Unesco and I.I.E.P., 1967). These and other relevant titles are included in the annotated bibliography at the end of this report. Not all the individual papers and reports mentioned in this chapter are listed in the annotated bibliography, however. For full references to them, and more detail and discussion than will be possible in this chapter, the reader is referred to the Stanford and Unesco publications just cited.

The Indian research

Let us first examine what India itself has done to measure the effectiveness of television as an instrument of instruction and development.

The limited television project centered in Delhi provides a small base for large conclusions. For the first six years of the project, all the receivers were in the city, and only in the last two years have receivers been placed in and programs provided for some of the villages within 25 miles of Delhi. Nevertheless, the studies of this Delhi project represent the only direct evidence we have of the effect of television in the Indian culture.

Dr. Paul Neurath, of New York, who was in charge of the pilot research on the rural radio forum in 1956, was brought back in 1965 to study the effect of school television in Delhi. At that time, television was being used in a limited way chiefly to assist in the teaching of science in Delhi secondary schools. He reported, in a study that unfortunately has never been published, small but significant differences in end-of-term performance in favor of classes that involved television. Although Delhi secondary schools are probably among the best in India, he noted that, by means of the broadcasts, students in these schools were seeing better experiments and better science teaching than even the best of the schools could provide. As a result, he said, "a change in attitude [toward science] and action taken [in science classes] is percolating through the whole school system, upwards from the teachers and backwards from the Director of Education" (Neurath, manuscript, 1965).

A carefully planned study, matching a sample of the 79 villages that have television receivers against a control group of villages, is now under way to measure the effect of the agricultural and community development programs presently being broadcast to the adult audience. Results of this study will not be available in time for inclusion in the present report. A preliminary study has been made of the village television service, however, by the Audience Research Service of All India Radio. It was found that two thirds of the adults who belong to teleclubs, and two fifths of those who do not, say they view the agricultural broadcasts regularly. More important, when farmers were asked about a number of agricultural innovations that were being recommended, 37 per cent said they had learned about these innovations from seeing them on television (as compared to just under 50 per cent who had learned about them from the village level worker, and 9 per cent from radio). Asked why they had adopted the new methods they were putting into practice, 33 per cent said they saw on television that these methods would "give better yields," as compared to 48 per cent who took the advice of agricultural officers, and just under 20 per cent who said they were influenced by their neighbors (All India Radio, Survey report on Krishi Daran, 1967).

We know of only one study of home viewing of television in India. In January, 1967, a sample of 387 adult owners of television receivers was interviewed concerning their viewing practices and preferences.

Almost exactly half -- 47 per cent of the men, 53 per cent of the women -- said they viewed television daily. Their preferences for programs reflected the rather bland television they were being offered. Preferences for types were in this order: feature films, short plays, sports, serial plays, and news. On the previous day, one particular serial play had an apparent program rating of over 80 per cent (S. C. Parasher, manuscript, 1967).

A suggestion of what might happen if more events, public affairs, and programs aimed at practical needs were presented, derives from the highly favorable reaction to Delhi Television's film coverage of the 1968 Haryana elections. This comment is from the Statesman (New Delhi) of May 20, 1968:

> Kudos is due to the Delhi Television Centre for its excellent coverage of the Haryana elections. To anyone who listened to radio and viewed TV during the last few days, the superiority of the latter must have been only too evident. While the radio abounded with bulletins, they never became anything more than a dissemination of cold facts. TV with its on-the-scene reportage and interviews at polling booths brought the complete drama of the Haryana State to the viewer and enabled him to participate in the excitement of campaigning, the exhilaration or disappointment of the opposing candidates.

Three other items -- of record rather than research -- have led observers of the Indian scene to believe that television would be able to attract large audiences and grip their attention, if it were to become widely available in India. First, there is a phenomenal interest in motion pictures. The annual attendance at films in India is about one billion. When a traveling cinema comes to a village, audiences gather from other villages miles around. Second, there is the long waiting list for new television receivers (at about $250 each) in Delhi, and when used receivers become available they sell at about twice the cost of a new set. Finally, there is the really extraordinary attention to television in the 79 villages where it is now available. A stream of visitors has come back from these villages in the last year, reporting viewing groups typically of several hundred all watching one 23-inch receiver. In the cold weather, if the receiver is placed indoors, people stand outside to watch through the windows.

Do viewers learn from television?

Let us now turn to evidence from outside India.

There have been hundreds of experiments on learning from television -- at the elementary, secondary, and college levels, at home and in school, in city and village, in childhood, adolescence, and adulthood, with gifted children and handicapped children, and with almost every kind of subject matter that people want to teach or learn. These studies are summed up in the Chu and Schramm volume, and in many other places, and there is no need to go through them in detail here. The conclusion is, overwhelmingly, that viewers learn a great deal from television. They learn from systematic teaching, and they learn incidentally from television things it is not planned to teach (for example, a study of two Canadian communities found that children in the community with television came to the first grade, at age 6, with vocabularies that averaged a year higher than children in the community without television -- see Schramm, Parker, and Lyle, Television in the Lives of Our Children, 1961). They learn facts, concepts, skills, values, and customs -- needless to say, not all of which may be socially desirable. But the evidence is so conclusive that there can no longer be any reasonable doubt of television's ability to be an effective instrument of information and instruction.

Here are a few examples from the literature. The first large experiment with instructional television in the United States, in Washington County, Maryland, found spectacular gains in the performance of many television classes, when measured against nationally standardized tests. For example, in junior high mathematics, the average achievement level of urban pupils rose in four years of television from the 31st to the 84th percentile, on national norms for tests of mathematical concepts. In grade 10 mathematics, urban schools rose from the 34th to the 51st percentile on national norms. Before television, schools outside Hagerstown were below the national norm for achievement on arithmetic in the third, fourth, fifth, and sixth grades. After one year of television, two of the four grades were above the national norm; after two years of television, all four grades were above the norm. Before television, students outside the city had averaged one quarter to one half a grade below the city students on standardized arithmetic tests; after three years of television, their achievement was comparable to that of students in the urban schools. This ability of television to equalize learning opportunities is obviously of the greatest import for a country like India. (Hagerstown Board of Education, report on closed-circuit television, 1959; also summary and discussion of results in the Unesco and Stanford volumes cited above.)

Not all the results in the literature are as spectacular as those, but they indicate beyond a shadow of doubt that a great deal of learning takes place, in a great variety of situations and uses. In Chicago an entire junior college curriculum has for ten years been offered on the air. Where there have been differences in the performance of students who took these courses at home and students who studied in the classroom, the advantage has been with the home television students (Chicago Junior College, report of research, 1966; also volume 2, Unesco cases). In Japan, an entire secondary school curriculum is offered by television and correspondence study, with highly favorable results (NHK report, 1968; also vol. 1, Unesco cases). Since 1960, Italy has used television (the widely admired series of programs entitled "Non è mai troppo tardi" -- It's Never Too Late) to help teach upwards of 100,000 illiterates to read and write (summary in volume 3, Unesco cases). When the United States Army tried teaching certain basic military skills by television, television students were significantly superior to conventionally taught students in five of 17 tests, and there was no difference in the other 12 (Kanner, Runyon, and Desiderato, 1954). United States Navy Midshipmen receiving instruction in basic electronics from television were found to score higher than Midshipmen taught by conventional methods (Boone, 1954). In the United States and more than a dozen other countries, television has been found to be a very effective tool of teacher training (for report of France's experience, for example, see Beltran, 1962). Crile (see summary in Audiovisual Communication Review, 1957) reports generally favorable results with agricultural television. There are at least 24 studies reporting effective teaching of health subjects by television (see Chu-Schramm study). A postgraduate program in medicine has been taught successfully on open-circuit television (Castle, 1963). Deaf students have been trained efficiently by television to a criterion of typewriting performance (Roy, Schein, and Frisina, 1964). The range of subjects taught successfully by television at all levels of school from first grade through college has included natural science, social science, mathematics, philosophy, literature, reading, foreign language, art. IBM has used television with considerable success for customer engineer training (Beatts, 1957). And the medium has even been used effectively to orient preschool children to the experience they would have in the first grade (Durost, 1961).

Thus, there is little reason to doubt that television, where it is needed, can be used effectively to carry any part of the teaching-learning process that a one-way, sight-and-sound medium can carry. It can't very efficiently conduct a discussion or run a seminar or answer questions that occur during the lesson. Obviously it can be used in some situations and some ways more effectively than in others. Therefore, let us set aside any doubt that it can be used effectively as an instrument of instruction and information, and inquire instead where and how it can be used most effectively.

When do viewers learn MORE from television?

This is a much more difficult question than the previous one, especially in the form it is usually asked: Do pupils learn more from televised or from face-to-face teaching? This is because it is extremely difficult to design media-comparison studies that are both scientifically rigorous and realistic. In the comparatively few cases where this rigor has been achieved (see Stickell, Penn State dissertation, 1963, and Chapter I of Chu-Schramm study) the results have inevitably been no significant differences. But we could hardly expect otherwise when the conditions for such a design are met: when exactly the same teacher and the same teaching are delivered (in one case by television, in the other by conventional classroom methods) to randomly assigned groups, and all other classroom activity relating to the subject is eliminated (because it might not be exactly the same in different classrooms at different times). Only a few of the several hundred media-comparison studies in the literature meet those criteria. Most of the others are, in effect, comparisons of what a school or an organization could do at one time or place using television, and at another time or place not making use of television.

The great majority of these studies, also -- most of them in the United States -- come out showing no significant differences. Where there are differences, more of them tend to be in favor of television than non-television. For example, the Chu-Schramm book was able to identify 411 comparisons of instructional television with conventional teaching. Of these, 308 showed no significant difference; 63 showed more learning from television, 50 more learning from conventional teaching. By some people, this will be read as a condemnation of instructional television: If it is no better than conventional teaching, why use it? On the other hand, even if we disregard the fact that much of the television was probably amateurish and many of the tests insensitive, and that the results can be explained in terms of the normal curve, still we must remember that most of the experiments took place where there were highly trained American teachers in highly equipped American classrooms. In this country, television has tended to be first tried and most used where it is least needed -- in the wealthy suburban school systems. It is not entirely surprising that one of these teachers in a studio would be able to do no better or little better than a teacher of equal ability in the classroom. But consider a different situation. Consider Niger, where only 66 teachers in the entire country have gone as far as secondary school; or India, where about one third of the teachers have not had teacher training. Consider the bare classrooms of most developing regions. Here there may be more reason to share excellent teachers and interesting demonstrations by television. In those cases, if a master teacher can be as effective in the studio as in the classroom, then he can be effective in hundreds or thousands of schools, rather than limited to one.

How does television compare in effectiveness with the other instructional media? There are very few such comparison studies in the research literature. Early in the history of television, an experimenter could get more learning out of a class by telling the students that they were seeing a television recording rather than a film (see Rock, Duva, and Murray, 1951), but this novelty effect has now passed. There have been studies showing that audiences remembered more from television than from radio newscasts carrying the same items (Westley and Barrow, 1959).

But in general, experience reports and case studies tell us more about this than do research comparisons.

Where a school or a teacher has a choice of using television or radio, television is almost always chosen except sometimes in the case of music or foreign language. On the other hand, where only radio is available, the results are usually good. Thailand has got good results from teaching 800,000 students partly through radio (see volume I of the Unesco cases), and a number of experiments with radio are listed in the Chu-Schramm summary. The chief advantage of radio over television is economic. Radio costs one fourth or one fifth as much as television. Thus, for example, Thailand can deliver radio to some hundreds of thousands of students for about one cent per student hour. Colombia can deliver television to some hundreds of thousands of students for about 5 cents per student hour. On the other hand, television has the great advantage of being able to deliver a picture along with sound. One would never choose to teach science or agriculture by radio, if he thought he could use television for it. It also has the advantage of attracting more attention and interest. This has been one of the findings that has most encouraged India to develop television. Students and adult viewers have liked it and paid close attention to it, and teachers have respected it enough to try to build it effectively into their classwork. On the other hand, the studies of radio instruction in Indian schools have not been encouraging. It has been considered a "supplementary" rather than an "integral" part of education. A survey in 1961 found that only 11 per cent of the schools equipped with radios used them regularly (Kapur, 1961). In a smaller study in 1956 (Gupta, 1956), 13 per cent of schools were found to be using their radios, and teachers were "silently hostile". However, the combination of radio with discussion in the famous Indian "radio rural forum", in Poona, in 1956, was highly successful. Later attempts to expand the radio forum idea nation-wide ran into difficulties from lack of support and personnel (Unesco cases, volume I).

So far as the research tells us, there is very little difference in learning from films and from television, when they are used the same way. Both have been used successfully to teach a wide variety of material at many different age and grade levels. The great advantage of films is that the teacher can stop the film at any point to talk about it, repeat part of it, or review the whole film if necessary; and he can schedule it for any desired time, assuming it can be obtained at that time. The teacher has no such control over television. On the other hand, it becomes a major problem to have films available and to deliver them on call over a large area and to many schools. In this kind of situation, the supposed advantage of the teacher in being able to schedule a film when he wants it, entirely disappears. When the service area reaches a certain size, there is a cross-over point at which unit costs of delivering television, by open circuit, become less than those for delivering films otherwise. This relationship has been figured out theoretically, and seems to come at a fairly early point in expansion of the system. A further advantage of television is that it can be changed and updated easily and quickly. This is why films tend to be used as supplementary teaching aids, directed at a few key points in a course, whereas television has more often been used as an integral part of the classroom experience, scheduled regularly day after day or week after week.

The point seems to be that any of these media can be used effectively, although in a given situation one may be more desirable than another. Where television is not readily available, for reasons of cost or equipment, then radio can do much. Where the service area is not too large to make delivery difficult, where a sufficient supply of films can be obtained, and where it is not necessary to use them to teach the core of a course, then films have certain advantages over any other medium. Television is the most flexible, the easiest to deliver, of these instructional media. The number of television receivers in American public schools is now reported to be passing the number of film projectors, despite films' head start of several decades. In developing countries where projectors are scarce, film collections sparse, distances great, and delivery difficult, the ability to deliver picture and sound electronically seems even more of an advantage than in a highly developed country.

How can a country maximize the effectiveness of instructional television?

Which medium is used, therefore, will depend on what a country or a school system can do, what its needs are, and the conditions under which it has to work. But if it uses television, what can it do to make it as effective as possible?

Here we get some help both from the case studies and the research reports. In the first place, it is clear that there is no substitute for a good signal and prompt technical maintenance. Several developing countries have floundered in television simply because of technical inadequacy (see the Unesco cases, volume 3).

Second, there is no substitute for interesting and skillful programming. Many schools have produced indifferent television because they have assumed that they could put a teacher in front of the camera and have her do what she does every day in the classroom. Television is a more demanding taskmistress than that. Teachers realize it, as soon as they have a little experience in the studio. They find they need more careful preparation, more attention to visual materials, more consideration of pace, review points, and questions to be answered before they are asked. And an agriculture program, too, is more demanding than the talk an agriculture agent would be giving in a village. Yet the whole implication of the research (see the summary in the final chapter of Chu-Schramm) is that effective use of television for instruction grows out of the basic requirements of good teaching, rather than out of any fanciness that might be peculiar to television. The qualities that emerge as determinants are factors like motivation, simplicity, good organization, practice, knowledge of results, rest pauses at appropriate points, cues that direct attention to the most important points to be learned, and so forth.

In the third place, it has become increasingly apparent in the last ten years that the effectiveness of television for teaching, whether in the schools or the villages, depends in large degree on the context of learning activities that can be built around it. It is not generally realized that television is used by itself hardly anywhere in the world to do an important teaching job. It is always built into a system. In the school, this includes the classroom teacher; and if that teacher is hostile to television and unwilling to build it into the classroom learning activities, then it will not be very effective. In teaching literacy, television is combined with a learning group and a supervisor. Agricultural programs work best when combined with the ongoing consultation of the agricultural officer and preferably into a discussion group of farmers, as is now done in India. In a sense, television works best in a kind of team-teaching situation -- the teacher in the studio, the teacher in the classroom (or learning group supervisor or village level worker), and perhaps other teachers or writers preparing study materials -- all these sharing the duties of providing learning opportunities around the receiving end of the television.

These general findings and others are discussed at some length, especially in regard to developing countries, in Schramm, Coombs, Kahnert, and Lyle, The New Media: Memo to Educational Planners (Paris: Unesco, 1967). Among other things, these authors conclude that television works best when it is not used "gingerly". Many uses of television have proved insignificant because the medium has been introduced without any clear idea of the need for it -- because "we ought to try out a little television," or simply because television time becomes available. The most successful uses have been those when an entire country or an entire school system felt deeply a need for the kind of help television could give -- for example, when Samoa wanted to jump from 18th to 20th century education in a few decades rather than a few centuries; or when the Republic of the Niger wanted to bring some hundreds of thousands of children into school but faced an impossible shortage of trained teachers. In that kind of situation there is some hope that television will be introduced in sufficient size to bring down the unit costs, and that teachers, administrators, and legislators will take it seriously, cooperate, support it adequately, and learn to use it well.

Essentially the attraction of instructional television to a developing country is that it can share excellence. It can share a good teacher with many classes, rather than one. It can carry a variety of auditory and visual experiences and demonstrations that would be impossible for an individual classroom or village, but not impossible for a central programming service. It can carry teaching where there are no schools. It can continue the training of teachers and development workers without bringing them into school. It can hold up a pattern of skill and knowledge for a whole country. These things do not happen automatically with the introduction of television, of course; they require skill, planning, investment, and organization.

How effective is television in developing regions?

The question that inevitably arises is how well television can serve a developing country where many of the needed resources may be in short supply.

We now have enough evidence to know that it can be and has been used effectively as a tool of education and development, for a variety of purposes, in many developing regions.

The Unesco volumes have case studies of television used for upgrading instruction in Niger, Nigeria, Colombia, and Samoa; for teaching teachers, in Algeria, Colombia, Nigeria, and Samoa; for extending the school, in Peru; for literacy and fundamental education, in the Ivory Coast and Peru; for adult education and community development, in Colombia, Peru, and Samoa. In addition to these we have studies of literacy teaching in Zambia, remedial instruction in Turkey, community development in Taiwan, improvement of secondary schools in Chile, agriculture and village development in Senegal, and others, beside the Indian studies cited at the beginning of this chapter. There have been many other uses, not formally studied, in such countries as Kenya, Uganda, Sierra Leone, Rhodesia, Egypt, Jordan, Pakistan, Singapore, Korea, Mexico, Jamaica, Brazil, and Venezuela.

In general, the research results from such studies as exist in developing countries, are quite encouraging. For example, let us take Niger, where a team of French scholars studied the introduction of television, one grade at a time, to share the handful of well-trained teachers as widely as possible. We have at hand the results of the first full year of teaching, in which the performance of first-grade students taught partly by television was compared with the standard average for students in that grade. It was found that:

79 per cent of the television students scored better than the standard average in spoken French;

88 per cent scored better than the standard average in reading;

56 per cent scored better than the standard average in writing;

more than half scored better than the overall average for arithmetic, but their performance varied with the level of abstraction -- in concrete problems, 89 per cent were better than average; semi-concrete, 87; mental problems, 75; applied, written problems, 50; abstract, written, 33.

The Niger examiners concluded that television in the classroom would not only produce satisfactory learning, but would considerably improve class performance over what it had been (Lefranc, in volume II, Unesco cases).

In Samoa, the high school entrance examinations at the end of the first two years of the television experiment made it possible to compare public school children who had been taught by television for two years, with those who had been taught in that way for one year, and with others who had received no television teaching at all -- and all these with another group of children who had been taught throughout the eight grades in private schools by American teachers. This first set of test results -- necessarily tentative pending later results -- indicates that children who have had television for even one year do considerably better in the entrance examinations than those who have had no television. Those who have been exposed to television teaching for two years do about as well as the private school students taught by foreign teachers. (Manuscript, personal communication.)

In Colombia, some thousands of children taught in part by television were tested against a comparable group taught from the same syllabus without the aid of television. This kind of comparison, of course, is subject to the same doubts that surround all the other media comparison studies. Nevertheless, it represents what the Colombia schools were typically doing without television as compared to what they were able to do *with* television. Eight meaningful comparisons were possible. In three of them, the television students did significantly better; in the other five the differences were not significant. (Comstock and Maccoby, 1966.)

In the Ivory Coast, it became desirable to teach 800 workers to read, write, and figure, so that they could be promoted to middle-level supervisory positions in the growing Ivorian industry. Few qualified teachers were available, but some of the best ones were put on television, and the workers were gathered together an hour a day in groups supervised by a monitor from their industry. The experiment was a success, and most of the 800 are now in their new positions in the native industry. (Kahnert, Capelle, and Lyle, in Unesco cases, volume 2.)

In Turkey, television recordings were used in teaching physics. The results were most interesting. Without the recordings, there was a wide difference between the performance of the students who had experienced teachers, and those who had inexperienced teachers. When the recordings were made a part of the course, however, the classes with inexperienced teachers did as well as the other classes. (Turkish Ministry report, 1961.)

From many countries come reports of the effectiveness of television in teacher training. In Algeria, for example, a combination of television and self-instructional materials, intended for teachers, was tested against a comparable group taught the same material in the classroom. The TV-self-study group did notably better. (Lyle, deJong, Kahnert, and Lestage, in Unesco case studies, volume 2.) In Colombia, an in-service course on the new math was given by television to about 1500 teachers. The amount of learning was impressive. The more programs a teacher viewed, the more he learned. And if a teacher viewed in a group, or in combination with a class, he learned significantly more than if he took the class only, or viewed without a group or a class. (Schramm, Coombs, Kahnert, and Lyle, The New Media, 1967.) From many other countries come reports, without research data, that merely seeing an expert teacher on television handling the subject matter taught in the classroom, has a profound and salutary effect on the performance of the classroom teachers themselves.

Another general finding of the studies from the developing regions is that television has a considerable power to motivate students, whether school children or adults. The research team in Niger reported (in the study cited above) that the first-grade students taught in part by television were happier, more spontaneous, far more interested in attending school. Unlike the other schools, there was almost no absenteeism in the television classes. "They not only come to school," the researcher said, "but they come early in order not to miss the first television transmission!"

In Zambia, Cripwell (in a study published in 1966) reported that literacy classes taught by television had a far more satisfactory attendance record than classes in the adult education centres where television was not available. "The holding power of television is a most important advantage," he said, "as one of the failings in many courses for adults, such as [these] is that the normal drop-out makes it almost impossible to run the courses efficiently." This is supported by a recent report of the NHK Television-Radio-Correspondence School in Japan (which is, of course, not to be considered a developing country). This school has just graduated its second class in a four-year curriculum of secondary school for employed young people. Television is an integral part of the curriculum, along with the usual correspondence study. The percentage of completion, the school reported, was the highest ever obtained by a correspondence school teaching secondary school subjects.

Are there special problems in using modern media to teach or inform village people?

This question remains: Are illiterate village people able to learn from television as readily as city people can?

There are a number of studies in the literature (see the summary by Chu and Schramm, pp. 37 ff) indicating that illiterate people often have to learn pictorial conventions which are familiar to mass media users. For example, when Peruvian villagers saw a health film showing enlarged pictures of lice, they thought these were an entirely different species of animal -- not the little lice with which they were so familiar (Holmberg, 1960). Court (in a 1959 study) found a Nigerian audience unable to understand at first the perspective in a picture. Fonseca and Kearl (1960) found that rural Brazilian audiences had difficulty in relating pictures of different parts of a process to the entire process. Spaulding (1956) found that realistic pictures were much easier than line drawings for rural people in Costa Rica and Mexico to understand.

These findings are not very worrisome, in the case of India, not only because it is generally found that the pictorial conventions are learned very quickly, but also because the great popularity of films in India suggests that most viewers of television there would already have been exposed to the conventions of visual media.

Summary

The research and case studies, then, leave us little doubt that instructional television can serve as an efficient tool of learning. This is not to say that it always does. But the evidence is overwhelmingly that it can, and, under favorable circumstances, does. This evidence comes from many countries, developed and developing; from studies of all age levels, preschool to adult; and from a great variety of subject matter and learning objectives. The questions that now seem worth asking, as we contemplate the potentialities of educational and developmental television for India, are not whether viewers can learn effectively from it, but rather, (1) does the situation call for it? and (2) in the given situation, how can it be used most effectively?

III HIGH-PRIORITY TASKS THAT CALL FOR TELEVISION

What are the chief uses for television in the development of India? High-priority tasks in national development should, of course, derive as directly as possible from national goals. But what are the national goals of India?

The Constitution of 26 January, 1950, sets forth rather general goals. For example, the preamble records the resolve of the people of India to provide for all citizens:

> "Justice, social, economic, and political;
>
> "Liberty of thought, expression, belief, faith and worship;
>
> "Equality of status and of opportunity;
>
> "Fraternity, assuring the dignity of the individual and the unity of the nation."

Later in the document there is a listing of "Fundamental Rights": equality, freedom, nonexploitation, religion, cultural and educational rights, property. There are also in the document certain "Directive Principles of State Policy" which instruct the government to undertake measures, within its means, to assure citizens an adequate livelihood, raise the standard of living, improve public health, provide free and compulsory education for children to age 14, and assure an equitable operation of the economic system.

Since 1950, statements by leaders of the nation, the successive Five-Year Plans, and writings of the intellectuals of India have made some of these goals more specific. We are going to refer extensively to Indian writings in this chapter to give a sense of the thinking that is going on, in that country. One of the best statements is by J. P. Naik, to whose book, Educational Planning in India (1965), we shall refer several times. Dr. Naik was the founder of the Indian Institute of Education and the secretary-general of the Indian Education Commission which reported in 1966. He is now adviser to the Ministry of Education. In the book just cited he has taken into account both the Constitutional directives and what national leaders and planners have said about goals since 1950, stating a set of national goals as they appeared to an educator in the middle 1960's:

"The first is democracy," he says (pp. 78 ff.). "The Constitution declares India to be a sovereign democratic republic which would assure the dignity of the individual and secure, to all its citizens, social, economic and political justice. It adopts adult franchise and direct elections to Central and State Legislatures, guarantees essential fundamental rights, safeguards the interests of minorities and backward communities, ensures equality before law and in regard to education and employment, prohibits discrimination on grounds of religion, race, caste, sex, or place of birth and abolishes untouchability. As an inescapable corollary of this basic decision, Art. 45 directs the State to provide, within a period of ten years, free and compulsory education for all children till they reach the age of 14. The second is secularism. The

State has no religion and it also treats all religions alike, in the sense that all persons have an equal right freely to profess, practise and propagate religion, to establish and maintain religious institutions and to manage their own religious affairs. Moreover, no religious instruction can be provided in educational institutions wholly maintained out of State funds while, in private institutions aided from State funds, no religious instruction can be made compulsory for any child against the wishes of his guardian.

"To these two important national goals, three others have been added in the course of the last seventeen years and especially since the adoption of the technique of planned development. The first is to eliminate poverty and to raise the standards of living of the people rapidly through the modernisation of agriculture and rapid industrialisation. To this end, it has also been decided to adopt science and technology which is also the most important factor in the conversion of a traditional into a modern society -- a transformation which is inescapably connected with the cultural renaissance of the society as a whole. The second is to create a socialistic pattern of society -- a goal which is implicit in the Constitution itself. Art. 39 provides that the State shall adopt a policy which will ensure that 'ownership and control of the material resources of the community are so distributed as best to subserve the common good' and that the 'operation of the economic system does not result in concentration of wealth and means of production to the common detriment'. The third is the national integration, the need for which began to be felt keenly as several fissiparous tendencies began to come to the surface, especially after the reorganisation of States in 1959 and which is essential to the maintenance of the hard-won freedom of the country. This has become especially prominent since the Chinese aggression of 1962, which has shown that Chinese expansionism now poses a very real threat to Indian freedom and to all the Indian values in life. These five national goals are at the very basis of all developmental plans, including those of education."

Every Five-Year Plan is, of course, a restatement of goals in specific terms. In the Fourth Five-Year Plan, as presented to Parliament on August 29, 1966, eight principal tasks are indicated. These are:

"1) To achieve self-reliance as early as possible. The highest priority will be given to all schemes of agricultural and industrial production which will promote exports and replace imports.

"2) To make the prices stable, all inflationary factors will be kept in check.

"3) Every possible effort will be made to get the maximum agricultural production in order to enlarge the income of the rural people as well as to increase the supplies of food articles and agricultural raw materials.

"4) For this purpose, the higher priority in industrial development will be given to production of fertilizers, insecticides, agricultural implements, diesel engines, and tractors.

"5) Production of articles like textiles, sugar, drugs, kerosene, and paper will be stepped up in order to have larger supplies of essential goods which the masses of our people consume.

"6) For the continued growth of metals, machinery, chemicals, mining, power, and transport industries, important both for national defense and economic self-reliance, schemes already in hand will be completed as quickly as possible, and only those new schemes will be undertaken which are essential to keep up the momentum of growth already built up and to meet needs during the Fifth Plan.

"7) In order to limit the growth of population, there will be a massive countrywide family planning drive.

"8) For the development of human resources the social services will be given as much facilities as possible; these will also be oriented in order to increase productivity."

In other words, the major thrust of the new Plan is to be on agricultural modernization, on increased productivity so as to make India self-sufficient on population control, and on such social services as health, education, and literacy.

The nature and significance of these goals cannot be adequately understood without knowing something about the conditions in which they are expected to operate.

India is, except for China, the most populous country in the world. One of its 17 states alone (Uttar Pradesh) if independent would be the seventh or eighth largest country in the world. India is a nation of diversity and contrasts. It is a nation of villages -- 568,000 of them, two thirds of which are not reached directly by roads -- but also a nation of large and impressive modern cities. There are great disparities between its very rich and its very poor, but the overall per capita income (share of gross national product) is little more than 50 dollars a year. Hunger exists in India, and when the crop is poor there is famine. The population is growing so fast, and the agriculture is so unproductive that the nation is compelled to go deeply into debt and import food to feed its people, instead of accumulating capital.

As the Indian scholar S. C. Dube has forcefully argued, the country is characterized by "small and significant pockets of modernity set against a vast hinterland of tradition" (Strategies of Community Development, East-West Center, 1965, p. 9). One of Dube's students, the young anthropologist Samarendra Saraf, has recently analyzed this situation as a background for the use of mass communication in support of development, and we are going to borrow some of his ideas. (Saraf, Economic Development and the Mass Media of Communication, ms., 1968, pp. 12 ff.)

"Planned change," he says, "is more or less an ideological warfare between the conservative forces of tradition and the progressive forces of modernity." What are these forces of tradition? He points out that the cultural diversity and ethnic heterogeneity, which provide surface picturesqueness and variety, tend to cover up a pervasive and persistent undercurrent of unity based on the village culture. This is a culture that, throughout India, is characterized by "nostalgic involvement with the place of birth, the joint family, and the caste affiliations," according to Saraf.

Saraf continues:

"Nostalgic involvement with the place of orientation is rooted in the psychology of the rural folk. Viewing their village not only as an environment of physical adjustment but also of broad social adjustments, they regard it as the 'country' of their ancestral forefathers who, for many recountable generations, had poured their sweat and toil into its soil and seeds, its cattle and crops, its water and weather, its norms and values. Their emotional identification with the place is further strengthened by their popularly held belief that the social milieu of their village ensures them a cradle-to-the-grave arrangement. Such a view of their 'little universe' only promotes parochial-mindedness and sedentary frame of mind which normally inhibits mobility.

"Patri-local joint family is an over-all structural orientation of Indian society. Joint family presents unique structuring and functioning of kin-grouping, and its attendant norms derive their moral sanctions from the resultant ideology that has grown around the institution. Broadly speaking, these provide another traditional anchorage to Indian society. The institution of joint family prevails and persists, especially in rural India, partly due to the sheer force of tradition of its relatively long historicity and survival, and partly because of its being a tried and tested pattern of ecological adjustment. For joint family often functions as an economic unit of production and appropriation.

"Their ideology preaches them to place high premium on the immediate kin-group that surrounds an individual upon his birth, and that nurtures him. This fosters and promotes reciprocity of obligations. . . . Individualism hardly, if ever, develops and is seldom favoured. Vicarious liability derives its moral sanction and support from the rural norm of helping even those economically unproductive and less productive, be they ever more a liability than an asset. Such attitude toward the infirm and the invalid extends, by social fiction as it were, to their livestock as well which are regarded almost as part and parcel of the joint family.

"Caste or caste-like appellations present another traditional mooring of the Indian socio-cultural context which fosters and favours conservatism through social norms. For, as an individual is born in a family, his socio-ritual status in the classical or quasi-classical hierarchy, his traditional calling and the entire cobweb of his structural relations with the members of other castes are all determined and pre-ordained. Normally, he enjoys only a certain amount of freedom as sanctioned by such broad socio-cultural determinism as is exercised by each caste through its zealously guarded norms, express or implied. The overall sweep of caste determinism on individual personality is often so pervasive that his political thinking and participation, his choice of economic pursuits, his religious belief and dogmas, his social interaction, his tastes and habits and his preferences and prejudices are largely furrowed along caste norms."

Even this analysis becomes more discouraging when there is added to the picture "such contributory factors as fatalist philosophy and the resultant apathy for change, high premium on spiritualism, antipathic orientation toward gross materialism and limited world view." But this is the background against which India seeks to modernize. It may be that "an entirely new personality structure needs to be nurtured before "the value system of traditional society . . . the sacred ritualism, cosmic love of nature, faith, minimization of wants, renunciation, other-worldly goals, rewards and punishments" can be replaced by the "secular, radical, innovating, and rational orientation" that modernization requires. (The quotation is from S. K. Srivastava, Directed Social Change, 1965, p. 155.) As values, therefore, independence and initiative must replace dependence, mobility must replace parochialism and rigid stratification, empathy and achievement-orientation must replace fixed status and changelessness, high participation in the shaping of society must replace the fatalistic conclusion that one can do nothing. India's problem of development is therefore nothing less than replacing traditional man with modern man -- or, more precisely, bringing about "vast adaptation" in traditional society in the direction of modern society. And this vast change must be translated into national action, lest the result of change be merely one of a feeling of frustration.

Saraf's conclusions as to what the mass media might contribute to such enormous and difficult changes are more than a little interesting to us.

The "first and foremost" thing, he says, is to "instil nation-awareness in the minds of the people." This step, he feels, must precede true modernization. The second step is to inform the people about "what new adaptations they have to make, what new and bold decisions they have to arrive at. The image of the new nation, of the new society, has to be presented before them, and the entire programme of planned change has to be spelled out before them in order to enlist their 'understanding participation' in the 'national effort'." They must be informed about "better ways" before they can be induced to change. They also must be shown how to change, by the teaching of skills and understandings.

"Education, the prime mover of modernization, will progress at a snail's pace if it were left to formal class-room teaching, . . . From agriculture to literacy, or sanitation to modern therapy, the mass media can not only widely disseminate new ideas and information to broaden mental horizons of the people, they can effectively play the teacher role as well." And as the instruction goes forward, it should increasingly become a dialogue rather than a monologue. As Dube has said (1965, p. 52) a program of planned change for the people should shift to a stage of planning with the people, and then to a time of planning by the people.

These ideas are by no means new to the western world, but the fact that they are being expressed so vigorously by Indian scholars, and especially by the younger generation of scholars, is a matter of considerable importance to us.

We have tried to translate some of this Indian thinking and planning into a few specific tasks, within the pattern of national development, which would seem particularly appropriate to the use of television. Obviously, if there were not appropriate challenging uses for television the conclusion would follow that a television satellite could not possibly have a very high priority in Indian education and social modernization. However, exactly the opposite is true, and the challenge to modern means of mass communication technology is perhaps as great in India as any place in the world.

Some of the areas where modern communication promises to be most useful are sketched in more detail in the following pages.

1. National integration

In the Gandhi years, India derived a sense of unity both from the leadership of the Mahatma and the drive toward independence. In the years after 1950, the leadership of Jawaharlal Nehru and the Congress Party helped to maintain a sense of unity. Recently, divisive tendencies have thrived on language and cultural differences and sensitivities, on less positive leadership and the formation of opposition parties and coalitions, and on dissatisfaction with economic and social rewards. So strong have these divisive tendencies become that some observers have questioned whether the States of India can remain together. Therefore, national integration, which we have just seen identified as the "first and foremost" step in modernization, is clearly now one of the most urgent goals of the Republic.

National integration, of course, does not necessarily mean national sameness, but rather a learning to live with diversity. As Naik says (p. 101), it requires a recognition that "within or in spite of this diversity . . . there is (or can be created) an underlying unity which makes it a nation. National integration may be said to have been achieved when every citizen has an understanding of this essential underlying unity in diversity, gets emotionally involved with it, and comes to regard it as so great a value that, if need be, he is prepared to sacrifice his all for its preservation."

There are several facets in achieving national integration, as Naik points out. One, he says, is to "inculcate the love of the motherland." This is not easy because India is not at the moment in position to do a great deal for its people: "It has little to give and quite a good deal to demand in return. The appeal for patriotism, therefore, must be made under more difficult circumstances; it is not the natural gratitude expected in return for favours conferred, but an appeal to idealism or to the generous instinct of giving one's all for something which one regards as 'valuable'. Men do respond to such appeals. Garibaldi promised his followers days of toil, sleepless nights, a life of poverty and difficulties, and an unceremonious death. . . . Gandhiji offered nothing better but did move the masses. Our appeal in the name of Mother India, for at least another 15-30 years . . . will, therefore, have to be similar and it will succeed only if the people feel that all these sacrifices they are called upon to make are worthwhile and are being made for something which is 'valuable'. For this sense of 'value', one can only build upon the past and the future. In other words, we must inculcate an understanding of and a proper pride in our great cultural heritage and also create a strong attachment for the equally great (or even greater) future we have in view." (p. 102)

Two other important aspects of national integration, he says, are economic equality and social cohesion. "Today, the divisive forces are too numerous and powerful disparities in wealth and standards of living, regional imbalances of development, caste, unequal status of women, inequalities in educational provision and religion. The adoption of socialism and rapid economic growth (in which education has a significant part) can help to overcome the economic factors. But education has a major role to play in overcoming the divisive social forces. Men have to be educated to regard women as equals and women, to a better appreciation of their own selves. The Hindus know fairly well how to live with 'other religions'; but they do not know how to live with themselves. They will, therefore, have to be educated to adopt a real democracy in their own midst by the abolition of caste. The Muslims can live well with themselves but they do not know how to live with others, because they have a built-in inheritance of democracy which unfortunately has often been interpreted as a closed system for the believers alone. They will, therefore, have to be educated for a life of co-existence with non-Muslims also. In addition, educational programmes, and particularly the programme of identifying talent and scholarships, will have to be deliberately and largely used to create social mobility which will cut across all barriers of caste, sex, race, or religion. These programmes will have to be greatly emphasised because national integration will be directly proportional to the degree of economic equality we introduce or the extent of social cohesion we promote.

"The creation of a unified elite is another major facet of national integration. In ancient and mediaeval India, the unity of the entire sub-continent was preserved, such as it was, by just one factor: the existence of an elite of Brahmins who had a common culture throughout India and who spoke a common language -- Sanskrit. In the mediaeval period, two different elites grew up -- Hindu and Muslim -- but the Hindus and Muslims came together only to the extent to which these two elites understood each other in search of common points of philosophy. In the British period, a new all-India elite was created which spoke a common language -- English -- and shared a common faith in several fields and it was the existence of this elite which created the underlying bond of unity. In the future also, the hard core of Indian unity will be the Indian elite. The educational system must, therefore, so operate that it will create a new elite with faith in India's past greatness and future glory, which will share all the common values indicated by our national goals, which will speak two common languages -- English for building up an international camaraderie and Hindi for communion with the Indian people, and whose ranks will be recruited purely on the basis of merit and without any reference to caste, race, language, sex, religion, or place of birth. The success in national integration will be directly proportional to the quality and quantity of this elite." (pp. 102-104)

Not all Indian leaders would agree with Dr. Naik's answer to the language problem in the page above, but they would agree on the importance and complexity of the problem of national integration.

What could television contribute to these facets of need? Perhaps the most effective contribution it could make would be to add a component of common experience, vividly and effectively reported, to the lives of all Indians. No leader of India -- not even Gandhi or Nehru -- has ever been able to speak to all of India. Only a tiny segment of the population has ever been able to witness or participate in the great events of the national life. Mobility, even for the elite, has been difficult, and relatively few people have been able to acquaint themselves with the cultures, the problems, and the languages of other States and peoples. But television could provide a surrogate mobility by which people could attend national events, meet national leaders, travel around India, arrive at decisions on a relatively common basis of knowledge. Furthermore, television could help teach the "bridge" languages of India, both formally and by the informal device of connecting these languages with entertainment or news events.

What would it mean to let all of India see Republic Day as celebrated in Delhi? This in capsule form is the challenge that television offers. And it is one service that television could begin to offer as soon as it became available. Against the divisive forces, the growing regionality and suspicion, it could offer the potential of a core of common experience, wider rather than narrower acquaintance with the country, an opportunity to hear issues debated on national rather than merely regional grounds, and a more nearly common national basis for decisions.

Could this be done equally well by other parts of the information system? No goal of such importance would or should ever be restricted to one medium, of course. But printed media would be handicapped in carrying out the assignment by the pervasive illiteracy, films by the necessary time lag, radio by its inability to show as well as tell. Only television could serve eyes as well as ears, overleap the literacy barrier, and be timely as well.

2. Upgrading education

"The destiny of India is now being shaped in her classrooms," said the Education Commission of 1966 (Report of the Education Commission, 1966, p. 1).

"Whether from the point of view of democracy, socialism, national integration, economic development, or cultural renaissance," says Naik (pp. 106-107), "two major educational policies stand out fully: (1) provision of equality of educational opportunity; and (2) the cultivation of excellence."

The Education Commission stated three related goals. (1) All levels of education must do more to relate education to productivity through programs of science education, vocationalization, and work experience. (2) The educational system must contribute to national and social integration through purposeful programs. (3) Teacher training, school curricula, and use of available facilities must be improved.

India has greatly expanded educational opportunities for its young people since 1950, as we have pointed out. It expects to reach the Constitutional goal of free and compulsory education to age 14 within 15 or 20 years. In 20 years it expects its school population to expand from 70 to 170 millions (Report, p. 3). Expansion of schools, teacher training, and budgets will therefore continue throughout at least the next three Plans. But, said the Commission secretary (p. 107), the program will have to be modified to secure equality of educational opportunity, because the rapid expansion secured in the first three plans has led to even greater inequalities -- among States, districts, and localities.

Furthermore, the quality of education in general has troubled Indian educators for some time. The Education Commission noted the high incidence of dropouts, failures, and low-level passes in the school leaving examinations. "The picture is particularly dismal in the rural areas and especially in the primary schools," said the Commission (Report, p. 224). "In the average school today, instruction still conforms to a mechanical routine, continues to be dominated by the old besetting evil of verbalism and therefore remains as dull and uninspiring as ever."

But to equalize and upgrade education requires a general upgrading of teachers and teaching materials, and probably a review and revision of curricula, over a school system that even now has 70 million pupils and will soon be well over 100 million. Moreover, this system has a rather high proportion of untrained teachers, as we have noted, and the

Education Commission has pointed this out. The Commission also notes that curriculum revision has lagged, and good teaching materials are scarce. Nothing less than a "radical alteration in the methods of teaching and in the training of teachers" will do, said the Commission (p. 615).

These problems will sound familiar to many educators, because they are precisely the reasons that television has been introduced into many schools in many countries. Television has shown over and over again its effectiveness for the in-service training of teachers -- both by means of formal courses directed at them, and by providing the example of excellent teaching at their own grade level. Television is unequalled among media in its ability to share excellent teaching, and thus even out the opportunity to learn in a system in which many teachers are ill-trained; and to deliver demonstrations and instructional aids to ill-equipped classrooms. In India, where so many teachers are inadequately trained and so many classrooms have very little equipment, these possibilities are especially attractive.

Furthermore, the introduction of massive technology like television provides an obvious point in development for a school system to review what it is doing, and how it is doing it. The Indian Education Commission recommended a redefinition of the content of general education, and a "unified approach" throughout the curriculum. It called for a basic reorganization, and warned against "moving forward with faltering steps and lack of faith." This might well turn out to be the greatest impact of television on the schools, for when television is introduced, and the television teacher finds his teaching opened to the inspection and criticism of his fellow teachers, then, special efforts almost always go into making a lively new course for television. It is an obvious time to review the content as well as the method, to decide whether to introduce new approaches (like the "new Math"), and to consider how the experience to be given the pupils measures up against the national goals.

The Unesco team concluded that television and radio, used in these ways, might play a considerable role in "making the educational revolution feasible" (Unesco COM/WS/51, p. 9).

Television rather than other media? In education, as in national integration, all media have important roles. The publishing industry has the responsibility of providing textbooks, the film industry of furnishing teaching films (either for projectors or for television), and radio could be used far more than it is now for direct teaching. Television, however, would have the advantage of being able to share teaching and demonstrations with a reality and timeliness that no other channel could match. We asked the question of many Indian educators -- would it be better to expand radio or television in support of education? Obviously, there is a financial component to the question: Would television take the money that would otherwise be used for teacher salaries or teacher training or new schools? There was a serious technical question, too: Could sets be maintained? But even with these concerns, there was general and strong agreement that an expansion of television could potentially accomplish more in the Indian situation, than the other media.

In Delhi, the fledgling television service is apparently proving helpful in the schools, as both the evaluation studies and the opinions of teachers seem to indicate. Considering that the teachers in Delhi are probably among the best trained at their respective levels, and that the schools are much better equipped than the average school in India, the prospects of extending this kind of experience to less fortunate parts of the country are most attractive.

3. Extending education

Dr. Naik is actually more optimistic than many Indian educators when he speaks of reaching, by the time of the Sixth Plan (in 15 years), the Constitutional promise of free and compulsory education to age 14. Even this will require special effort. And the feeling is growing that the goal is itself insufficient: Free (not compulsory) education must be offered at least to ages 16 or 17, and both the higher levels of formal education and the reach of adult education must be considerably extended.

In specific terms, this will require that (a) dropouts be reduced, (b) new schools be established in many more villages (now about two thirds of the habitations in India have primary schools, many fewer have middle and secondary), (c) the middle secondary, at least, must be greatly expanded (now only about 33 per cent of the children in this age group are in school), (d) fundamental and specialized education for

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adults must be offered much more widely than it is now, and (e) the opportunities for university education must be enlarged.

The problem of extending education, like the problem of upgrading its quality, points to television.

Experience with television in education would indicate that it could be useful in three ways in a program to extend education. For one, it has shown an ability to motivate students and reduce dropouts. We have cited some of this evidence in the preceding chapter.

In the second place, when new schools must be added, it is not always possible to provide enough highly trained teachers as quickly as new buildings can be constructed, nor to equip all the classrooms with the instructional aids that modern schools require. If television is available, however, it is possible to use some less-well trained teachers in the classrooms, as partners of the expert teacher on television, and to introduce by television some of the teaching experiences and demonstrations that the classroom lacks. This has been done in Samoa, in Niger, in Italy, in Colombia, and many other places, and in all those places it has enabled education to expand more quickly and at a higher level of quality than would otherwise be possible. (See New Media in Action, 1967, vols. 1-3.)

In the third place, the combination of correspondence study with either radio or television has proved an extraordinarily powerful and flexible method of expanding education. Correspondence plus radio has been used for years in New Zealand and in the "outback" of Australia, and thousands of children have been educated in that way who would otherwise never have gotten to a school. Many young people have had all their education up to the university by that means. Japan has used the combination of television and correspondence study, as we have noted, with considerable success in the case of students of high school age who have been unable to gain places in the residence high schools. Chicago has taught a complete junior college curriculum by a combination of television and a minimum of paper writing and telephone consultation. Therefore, the possibility of using correspondence study plus television or radio to offer college courses, specialized technical or vocational courses, or even secondary school where schools are not available, is a possibility that might truly help India to expand its educational system more quickly than would otherwise be possible. (Summaries of this evidence can be found in New Media in Action, and The New Media, both 1967.)

The question of whether this must be done by television or by some other medium has to be answered differently for the three means described above. Radio has proved such an effective partner of correspondence study that there is no reason why India need wait for television to use that combination, although should television become sufficiently available it would recommend itself for use with technical courses and other correspondence study where the student needs to see demonstrations. For the other two purposes, however -- for reducing dropouts and creating "teaching teams" of a master teacher in the studio and a less-well trained teacher in the classroom, there is no evidence that radio works as well as television, or indeed that it works very well at all except in subjects like language and music that depend so much on sound.

4. Strengthening the vocational and technical component of education

The Education Commission and other concerned observers have already been quoted on the need for bringing Indian education more nearly into step with employment needs and opportunities.

"The number of students who attend vocational courses at the secondary stage in India is probably the lowest in the world," says Naik (1965, p. 45). "In West Germany, for instance, about 70 per cent of the students at the secondary stage follow vocational courses which prepare them for life. In Japan, this percentage is about 60. The position in most of the advanced and industrialized countries is the same. But in India, only 12 per cent of the students enrolled at the secondary stage follow vocational courses. Our programmes of rapid industrialization are being held up for want of 'middle-level' personnel which only the vocational secondary schools can produce. During the next two plans, therefore, the proportion of students at the school level of education who take to vocational courses will have to be increased to at least 40 per cent and these programmes of vocationalization will have to be accorded very high priority."

But vocational education costs at least 50 per cent more than general education, and vocational teachers are in very short supply. Furthermore, it is not going to be sufficient to offer vocational training at the secondary level unless steps are taken to improve the technical component of education at lower levels, and to change the attitude of students toward working with tools and machines, rather than in white collar civil service positions. Therefore, the problem is partly one of reviewing the direction of the curriculum, and partly one of providing special services to vocational classrooms.

How could television help? For one thing, by helping to improve the teaching of science throughout the school years. Again, by sharing some of the best vocational teachers widely, so that vocational classes can be offered in schools where well-prepared vocational teachers are not available. Clearly, there is need for training films, scientific films, and films on employment opportunities, but these might be delivered by television much more efficiently than they could be delivered individually to schools for projection. It is interesting to think of the possibilities of exposing students to technical employment opportunities which they otherwise might not see -- to factory work, maintenance and construction work, scientific agriculture, and so forth -- which might well change their image of possible careers. Would it, for instance, perhaps be possible to offer some television time to the Federation of Indian Industries or other large-scale employers for in-service or pre-service training programs?

In other words, it would seem that if television were available it could be used both for technical and scientific teaching, and for exposing students to the coming world of technology in which more and more of them should be seeking employment. Thus it might contribute in an important way to bringing the schools into touch with realistic employment possibilities, and so encourage productivity and the efficient use of human resources.

The Education Commission (Report, p. 6) felt that introducing such a component was as necessary for the future of education as for that of industry and agriculture. "Education is in transition from a society in which education is a privilege of a small minority to one in which it could be made available to the masses of the people," said the Commission. "The immense resources needed for this programme can be generated only if education is related to productivity so that an expansion of education leads to an increase in national income which, in its turn, may provide the means for a larger investment in education."

5. Modernizing agriculture

Very nearly 70 per cent of India's entire working force is in agriculture, and 50 per cent of the national income derives from farming. Yet the yields per acre are exceedingly low, India has to import a great deal of its food grains, and a national effort is being made to modernize agricultural methods and double production by 1980.

In 1966-67, for example, 25 million rupees were spent on digging wells and irrigating over 2 million acres of farm land; 72 million rupees, on soil conservation; and numerous plans were being implemented, at various levels of cost, to produce and distribute fertilizers, insecticides, and other necessities. The modernizing of agriculture was the main assignment of village level workers throughout India. And yet, in 1966, India had to import over 5 billion rupees ($667,000,000) worth of food grains to keep its people alive (India Yearbook, 1967). It is tantalizing to think what could be done with that amount of money if once it could be used for development rather than subsistence.

This year, the crop is better, and much less food will have to be imported, although large sums will be needed for importing fertilizer and other supplies. But every year will not be a good crop year, and the need remains to introduce new methods of farming, new varieties, greater amounts of soil testing, and new equipment.

With new technology comes need for information on how to use it. Farmers ask, says Dr. R. Lyle Webster, former director of information for the U.S. Department of Agriculture, who is now Ford Foundation consultant on the Agriculture District Program in India, "how shall the new crop be planted? What diseases is it susceptible to? What do I do to protect it against insects? How much fertilizer shall I use? What times shall I apply the fertilizer?" ("The Use of Television in Indian Agriculture," 1968, p. 1)

But the answers that are good today will have to be brought up-to-date tomorrow. While farmers ask for more and more information, the village level workers have more and more difficulty keeping up with new developments. Therefore, there is a pressing need to keep a flow of information going to the field adviser as well as to the farmer himself.

What can television do about it? Clearly, it cannot do the whole job itself. An effective agriculture information service needs bulletins, posters, demonstrations, and people, as well as audio-visual channels. There are times when a farmer needs to be able to ask someone a question, and other times when he needs to see how someone else has done it. Looking at the situation in India, it is obvious that neither the resources of the printed media nor of local radio have been used as fully as they might be.

But what Webster says about the usefulness of television carries weight because of his long experience as head of the multi-channeled information service of U.S.D.A. and his knowledge of India. He writes:

"The potential impact of television as a means of informing farmers is greater than that of any other means of mass communication. With television, as with the motion picture film, the farmer can hear what is to be done, can see it done, and can see the results. By filming a new crop being tried one year, it is possible for the next year to show the farmer all the steps in growing the crop before he has to try it himself. He can be shown close-ups of certain operations, of the appearance of the crop suffering from disease, and he can see the stage of growth at which a crop must be before certain treatments should be carried out. Unlike the motion picture, television conveys the feeling of immediacy. In this sense it combines radio's intimate quality with the motion picture's ability to magnify the smallest detail so all can see.

"With television available, and if there is adequate programming on agriculture, the farmer can get information regularly, and frequently. Television offers a continuing impact on the farmer, whereas educational film showings, while effective, are infrequent." (p. 2)

Agricultural television is now being tested in 79 villages near Delhi. Programs are popular, and first tests, as we have indicated, suggest that they are implanting a good many new ideas about farming methods.

It may be interesting to note how India is now using television for agriculture. There are two 20-minute programs a week, in early evening. Teleclubs have been organized in each village. A large group of villagers watches each program, but the teleclub -- made up of about 20 farmers -- assembles for a discussion immediately after the program.

The first item in each program is a series of answers to questions sent in by the teleclubs, and reports of actions initiated in the villages. Then comes the main part of the program: A farmer and an agricultural expert discuss the topic of the day. There is little or no lecturing. Most of the footage is filmed in the field, showing actual problems and their solutions, which are discussed by the two spokesmen. Finally, if time is available, there is a brief segment of rural dancing, singing, or folklore.

This is the pattern of the radio rural forum, and indications are that the rural teleclub will be at least as effective as the forum was in its most successful years in Poona.

Other uses of television for agriculture suggest themselves. One of these is to provide up-to-date weather information, which is always of importance to farmers. Another will be market information, as farming moves out of its subsistence stage.

The Unesco team evaluated the possibilities of agricultural television as follows: "In food production, India cannot wait until 50 million farmers become literate. The main question is how to reach large, mostly illiterate groups of the population for whom even functional literacy provides only part of the solution to the information problem. Information must be received by the farmer now and a constantly increasing flow of information must be maintained over the years immediately ahead. At best, extension specialists and demonstration-cum-training camps will reach less than one-tenth of the villages in India; films will reach fewer still, even radio is received in only about two-fifths of the villages, and television is virtually nonexistent. But of all the mass media television is the most compelling. It has immediacy, it brings immediacy in both visual and aural terms. The televised field demonstration is second only to being there in person. . . There is no alternative to using mass communication methods. Great progress has been made since Independence in agricultural experimentation . . . but this information is reaching only a small percentage of the farmers. In short, the information is available and processed but the delivery system is lacking." (pp. 12-13)

6. Family planning

The population of India is growing at the rate of about one million a month. The annual growth of 2.5 to 3 per cent is nearly equivalent to the increase in gross national product. In years of bad crops, when it is necessary to import great quantities of food, the average per capita income reflects no growth in national product whatsoever, and in some cases actually decreases. This is the reason for India's great concern over productivity in agriculture and in children. If the economy is to grow it is thought necessary to reduce the average annual birth rate from 41 per thousand to about 25, which would cut the annual population increase from 2.5 to a little over 1 per cent, as against an expected average annual G.N.P. increase of about 4 per cent.

Family planning has therefore become one of the priority activities in planned national growth. It is no secret that the campaign has so far been disappointing.

The magnitude of the problem can be illustrated by the size of the necessary target audience. The target is nearly 100 million couples in the reproductive ages of 15 to 45 -- plus perhaps another two million influential persons outside this age bracket -- plus more millions nearing the age of marriage and reproduction. The most optimistic estimate at the present time is that perhaps one per cent of this group has accepted the recommended methods.

India's family planning program, therefore, is aimed at achieving two goals, neither of which will be effective without the other. One is to persuade the couples in the reproductive age that it is desirable to limit family size to three children. The other is to provide efficient and readily available family planning services within every one of India's 5,200 Block divisions.

The campaign presently stresses a few simple themes (principally, the slogan "two or three are enough,") that are being carried through all available media, including posters, meetings, radio, mobile film vans, and even elephants that walk from village to village to advertise the campaign. Mostly to improve and extend medical and health services related to family planning, the Fourth Plan proposes an allocation increased from 270 million to 450 million rupees.

But the problem is time. Extending health services through 568,000 villages is a slow task. Persuading 100 million couples, 80 per cent of whom live in villages, will take a long time in any case, but especially if these people have to be reached entirely by interpersonal communication. The Department of Family Planning has succeeded in gaining an appropriation to buy 335 mobile units entirely for family planning, but these will not be in service with trained staffs for several years, if at all, and even so they represent only 1 van for every 1,700 villages. Meanwhile, the population continues to increase at such astounding rates that, as Mr. Chandrasekhar, the Minister of Health, says, "Our house is on fire!"

Despite the intimate nature of much information on family planning (which makes an information campaign in this field essentially different from a campaign in agriculture or most health fields), television is an extremely attractive prospect for the people who are trying to carry the message of population control to India. It could leap over the literacy barrier and the distance barrier. "If television were present today in two-thirds of the country's villages and towns," says Frank Wilder, Ford Foundation expert consultant to the Family Planning Department, "little other effort would be required in meeting the need for initial public awareness of family planning and interest in adoption of birth control methods." Notice that he speaks only of "initial awareness" and "interest". Obviously, these must be followed up by expert advice, medical assistance, and ready availability of materials. But it would be an enormous step forward, an enormous saving of precious time, if this message could be carried by sound and sight into a substantial number of villages.

The Family Planning staff is not hopeful that television will arrive in time to do any good. "Under no circumstances could India install a television system sufficiently widespread and far-reaching *in time* to make a significant contribution to the family planning mass communication task," Wilder told a seminar in Delhi. But yet, is there any faster and feasible way to do it?

7. Teaching literacy

"It is a national disgrace," wrote J. P. Naik bluntly, "that the percentage of literacy [in India] is still as low as 24. Almost every programme of development, particularly in the rural sector, is now being severely handicapped on account of mass illiteracy."

In all fairness, it must be pointed out that India includes its preschool population in figuring its total literacy. Most countries calculate the percentage only on persons 15 and over. Therefore, a percentage of 24 in India (as literacy was reported in 1961) might correspond to something like 30 in most countries that report literacy to the UN. In any case, however, the proportion of illiterates is high indeed and seriously discouraging to economic growth. The Unesco team estimated that 78 per cent of the rural population between 15 and 25 --

the group now moving into adult responsibility -- are illiterate. We suspect that the figure is presently a little lower than that, but even so it is clear that nearly three-fourths of the group on whom India is counting to create a new agriculture and a new village life cannot make use of the printed word. Nearly 60 per cent of the people who enter the labor force each year come in unable to read and write.

About 500,000 adults between 15 and 45 are now being made literate each year by social education and advanced literacy classes. This is about three tenths of one per cent of this population group. Total literacy in the 15-45 group is still nearly 70 per cent.

Obviously the slow rate of adult literacy teaching is not going to make a substantial dent in the problem. This is why educators and community development personnel in India are thinking what could be done with the aid of television if it were available. Again it is agreed, of course, that television could not possibly do the whole job, but would have to play a supportive and supplementary role. However, could it not provide some of the enthusiasm, the sense of national support, that a broad literacy campaign always requires? ("There is a need for professionalism, but there is also a need for enthusiasm," said Gunnar Myrdal, in The Asian Drama, "The literacy drive must have the characteristics of a national movement and a campaign; otherwise its chances are scanty.") Furthermore, could television not provide some of the professionalism? As in Italy (with the program "Non é mai troppo tardi") could not the scarce supply of trained literacy teachers be shared on television so that less-experienced literates could be placed in charge of many of the study groups? Could not television be used to provide some of the audio-visual aids, and the dramatized experiences, which are so difficult to provide locally? Could it not be used to train monitors and supervisors for local study groups? Given the availability of television, could not literacy training be woven into agriculture and health programs, so that there would be a practical usefulness for the skill being learned?

The people closest to this program in India believe it could be so used, and with great effect, if it were available. They point out that it would not substitute for the printed material on which aspiring literates would practice, or the material (with adult ideas but simple vocabulary) on which they would need to employ their new skill after they learn it. Nor would it substitute for the effort of organizing literacy study groups and providing monitors or supervisors for them. But it could significantly speed the process of teaching literacy, perhaps to the point where the goal of a completely literate adult population would be within sight.

They point out another possible contribution. Even while television is contributing to the formal teaching of literacy, it would be leaping over illiteracy. People could therefore learn from it as villagers have learned for centuries, by image and spoken word; and if at the same time the opportunities and desirability of becoming literate were woven into this other communication, it would provide incentive for learning to use the printed word also.

8. Contributions to rural life

In her discussion with us, the Prime Minister of India expressed the opinion that one of the tasks in which television could be especially helpful is to make the village community a better place to live so that the more ambitious and better-educated young people will not want to leave it.

This, of course, is one of the reasons to improve agriculture, health, and general economic conditions in the villages. It has also been one of the chief reasons for organizing teleclubs and social education programs in the tiny segment of India where television has been available. All India Radio submitted the following statement in a report to a Unesco Advisory Committee:

"Broadly, social education programmed for tele-clubs are designed to furnish information in a manner understood easily by the viewers. These help in bringing about a change in their attitudes, in their behavior pattern, toward their neighbours, against harming public property such as historical monuments, public parks, etc. They also help to assimilate the benefit arising out of discussion of the topics in greater detail. While planning the programmes the guiding factor is to provide material for thought for the viewing community in the tele-clubs, stimulate programme discussions with possibilities of follow-up action for the good of their respective localities. With this end in view a wide range of utility subjects is covered in the tele-club programmes: Consumers' Cooperatives, Family Planning, Repairs to Domestic Appliances, First Aid, Yogosans, Environmental Cleanliness, Weights and Measures, Activities of Social Service Centres, Kitchen Gardening, Utilization of Waste Material, Health and Hygiene, Observance of Traffic Rules, Do It Yourself Hints, Careers for Youth (Vocational Guidance) are some of the subjects which figure in these programmes." (Unesco COM/CS/164/4/Annex 5, pp. 1-2)

Putting aside the question of whether these present programs are accomplishing what they are intended to, it seems clear that if television were available in any substantial number of villages it could be used both for a variety of useful programs, and also for more general information and entertainment that would make the village a more cosmopolitan and rewarding place to live. For example, it could provide news with a vividness that would otherwise be impossible. It could lessen the isolation of the village by letting villagers experience other places and other cultures. It could bring them famous people and important issues. And not to be disregarded is the usefulness of an hour or two of entertainment programming a day, and what that might mean for the attractiveness of village life!

It hardly needs saying that television could contribute to rural life also by helping in the in-service training and the flow of information to extension staffs -- the village level workers and social education officers -- who work in the villages. It could reduce their isolation even while it helps them do their job better.

9. A note on probable impact, and a summary

In short, there is no reason to doubt that television could perform important services for Indian life and national development, if the medium were to become widely available.

The present popularity of the small television service in Delhi -- which we have mentioned in the previous chapter -- is one piece of evidence. Projecting that toward possible future impact, it is worth noting that television has the great advantage of being able to reach its viewers in the way that has been traditional in Indian life -- with a combination of sound and image. It is neither halted by the literacy barrier, nor restricted to one sensory channel. It can speak to the people as they have always been spoken to. As a result, scholars, broadcasters, development planners in India feel that it has the potential of a greater and swifter impact on Indian life than any other medium.

However, the impact of television on developing societies is very much more than the information it carries. It actually introduces a new element into life, especially in the village. It offers so much information, so much entertainment, that it can bring about fundamental changes both in daily life and outlook. In this sense, it is indeed true that "the medium is the message" -- that there is a media effect independent of the message effect. There is a new source of enjoyment, a new source of instruction, a new window on the outside world, a new demand on certain hours of the day. New status figures are introduced, new opportunities are depicted, and, while television is on, the isolation and drabness of the village are no longer so depressing.

It goes without saying that the way television is used will determine in part its impact. If it is programmed dully, it will be boring. If it implants the desire for change without an infrastructure that can meet the requirements for change, it will merely make more dissatisfied people and cause more of them to leave the village. And it may create an "image problem" for Indian political leaders, just as it does elsewhere in the world!

But, granted these caveats, it is our conclusion -- backed up by substantial evidence and by the opinions of many Indian scholars and leaders to whom we have talked -- that television, used well and widely, and woven into an adequate national program in fields other than information, could make substantial impact on the pace of Indian development by helping:

-- To provide a common element in experience in furtherance of the goal of national integration.

-- To upgrade education, particularly in the in-service training of teachers, the sharing of some of the best teaching and the best demonstration, and the equalizing of learning opportunities even to the most deprived village schools.

-- To extend education, by helping to reduce the number of dropouts, by making it possible to establish schools faster than fully trained teachers can be provided, and by combining with correspondence study to offer learning opportunities (particularly in the vocational and higher levels) where schools or student places are not available.

-- To strengthen the vocational and technical components of education, so as to bring the school system more into step with the employment needs and opportunities of India, and thus contribute to national productivity.

-- To help modernize agriculture by providing current information to field extension workers, and supporting their work with televised demonstrations and expert advice.

-- To bring about awareness of and interest in the family problem more swiftly and widely than could otherwise be done.

-- To speed the teaching of literacy, through motivating attendance, sharing expert instruction, and providing audio-visual aids for local study groups.

-- To make rural life pleasant enough to keep more of the ambitious and better-educated young people in the villages where they are so badly needed.

In other words, given a corresponding development in related parts of the program, television, we feel, could make a difference.

IV. CONSIDERATIONS IN DECIDING UPON SATELLITE TELEVISION

Granted that television could contribute significantly to education and national development in India, certain very important considerations would still have to enter into the decision whether to expand it nationally, and especially whether to deliver it by satellite. What resources would have to be committed? What technical support -- manufacturing and maintenance, for example -- would be required? What personnel, at different levels, would have to be trained? What problems in organization and coordination would have to be solved? And what degree of effort in planning, curriculum review, and program preparation for an extensive television service would be necessary?

It will be evident, on reflection, that most of these are television, rather than satellite, questions. No matter how television is delivered, any major expansion of it will require a large capital investment and considerable operating costs; hiring or training of a large number of skilled personnel, both on the program and technical sides of the operation; an increase in the present technological capability to manufacture and maintain receivers; attention to problems of control and organization that are not bothersome so long as television exists in miniature in one city only; and new challenges to the programmers, educators, and national development agencies that plan to make use of television.

Satellite delivery of television would exacerbate some of these problems. For one thing, the need to provide a satellite might increase the capital investment in the initial stages of expanding the system. Overall, however, the space link will be a minor part of total system cost; receivers will be the main item of expense, whether the television comes from ground-based stations or from space. Technical requirements (except developing, launching, and positioning the satellite, which would supposedly be done by one of the nations where aerospace technology is advanced) would not be essentially any more complex than for ground-based television; and, indeed, if it were possible to substitute satellite transmission for some ground interconnection and for a certain amount of local station operation, the technical demands on a country like India might actually be less in the case of a satellite than a ground-based television system. Because the use of a satellite would make it possible to speed up the expansion of television over India, it would also create pressure to speed up the training, the planning, the manufacture of receivers, the reconsideration of program content, and so forth, but these would be differences in magnitude rather than in kind. Because the introduction of a satellite would be dramatic, it would focus more attention on the problems of control, organization, and programming than might otherwise be the case, and force difficult decisions and action. But the only consideration in which there appears to be an essential difference between the requirements of ground-based and satellite television is in the strategic problem of programming from a central distribution point to a large area with varying needs, different languages, and heterogeneous cultures.

We shall discuss this last problem at some length. But first, let us suggest some of the considerations that must enter into the decision to expand any kind of television over a large part of the nation, in support of education and national development.

Capital investment and operating costs

In the following chapter we shall present some estimates of the cost of various strategies for expanding television over India. They make it clear that whatever system of national television and whatever schedule of expansion is decided upon will require a large investment and will therefore raise two related questions: (a) are there less expensive ways than others to do the job and (b) are there satisfactory ways to expand the system gradually and thus ease the financial burden by spreading it over a period of time?

Merely to place a large-screen receiver for black and white television in 80 per cent of India's 568,000 villages would cost at present prices upwards of $150 million. Indian Posts and Telegraphs estimates that 24,000 kilometers (14,400 miles) of microwave circuits would be required to interconnect a national network of 150 stations, at a total cost of approximately $95 million (about six million rupees per 200 kilometers or $6,667 a mile). These costs seem high compared with experience elsewhere in the world, but they are in line with Indian estimates for costs of other components.

Prasad Vepa, in a paper for the UN Space Conference (Vepa, 1968, Annex 1), estimates the total capital cost of a national network of ground stations at $394 million. His figures include the cost of a receiver for every village, but do not include any operating costs. In the latter category, he estimates annual maintenance alone at $26 million. On the basis of current All India Radio costs and estimates, it is possible to guess that annual operating costs at present unit levels would be in the neighborhood of $20 to $30 million plus maintenance.

The above figures at least illustrate the order of magnitude of cost estimates the Indian Government has to face when it considers a national television system for India. To cover most of the nation with television by means of ground stations interconnected by microwave, is estimated by Indian engineers and broadcasters to cost somewhere in the neighborhood of $400 million, in addition to an annual operating and maintenance cost of perhaps $45 to $55 million. If this seems small in comparison with the investment and operating costs of a U.S. television network, it must be remembered that the national income of India is in the order of $30 billion, as compared to $750 to $800 billion for the United States.

A further complication for India is the fact that about 30 to 40 per cent of the capital investment would have to be in foreign exchange, unless the local electronic industry were to be built up considerably more than at present. And in India foreign exchange is in extremely short supply and great demand.

It is understandable, therefore, that India has moved slowly into television. The tentative television component of the Fourth Plan, for example, provides for only minimal facilities at four new stations.

Even AIR's most optimistic projections call for the completion of 56 stations (plus 15 relay points) in the 15 years from the beginning of the Fourth Plan -- and this projection is now being reviewed with the probability that it will be revised sharply downward. Complete national coverage seems so far in the future that AIR has not even put a tentative time on it.

This is the dilemma facing India's policy makers. On the one hand are compelling financial reasons for moving slowly into the expansion of television. On the other, is the knowledge that television for national integration, and for rural and educational development is needed sooner rather than later. Furthermore, meeting many of the national goals in development and education depends directly on the ability to communicate on a mass basis, particularly to the villages which form the backbone of Indian society.

As a consequence of this dilemma, many Indians have begun to think seriously about the possibility of delivering television with the aid of a satellite, or transmitter-carrying airplanes, or combinations of various kinds of systems. A summary of the various plans and estimates which have been advanced for India is contained in Appendix B. If these estimates are correct, the cost of delivering television either by direct broadcast from a satellite, or rebroadcast through inexpensive ground relay terminals, could be considerably less expensive than the cost of a completely ground-based system, and the system could probably be expanded more swiftly. If this is the case, if the newer systems prove to be technically feasible, and if it is possible to move into one of them gradually enough to ease the financial burdens of the first five or ten years, then it might be possible for India to afford the cost involved and reap the benefits of using television widely in its development program. This is the line of reasoning being advanced with increasing frequency in India today.

Are there cheaper ways?

Here it may be well to mention at least two of the alternatives that have been suggested in India to save some of the formidable cost of national television.

One of these is the intensive development of radio instead of television. The argument goes like this: India already has a long start in radio. At a fraction of the capital cost and the programming expense required by television, dependable radio service could be extended over all of India, and a number of local radio stations could be built to serve the needs of special agricultural areas and language groups. Thus, in a few years it would be possible to have the national service combined with attention to local needs and interests that would take decades to achieve with television. Furthermore, India has hardly begun to use the resources of radio as fully as they might be used for education and development. The school programs, for example, are for the most part supplementary rather than integrated into the curriculum, and, if we may judge from the studies of Kapur, Gupta and Tagare (cited in Chapter II and in the bibliography) they are little used in the classroom. But India has achieved a considerable maturity in radio.

It has many hundreds of experienced people on both the program and the engineering side. It manufactures radio receivers. It could expand its radio service without having to suffer many of the growing pains and delays that will inevitably accompany the expansion of television. Therefore, why not radio rather than television?

There is no doubt that it would be of great aid to India if more local radio stations and programs were available. But the fact remains that the bland program service of All India Radio has so far not been considered a major mover in development. The impact of further extension of radio would undoubtedly be far weaker than the broad expansion of television. The effect on national integration, on school learning, on people who are seeking to learn the skills of development, would certainly be less with radio than if they could be brought pictures as well as sound. Furthermore, the large cities of India want television. This is why the pressure is now behind television rather than radio.

Experience elsewhere indicates that television does not replace radio; in fact, in some ways radio becomes even more significant. But television takes over many of the things that radio has done, and radio assumes tasks more uniquely suited to it. Therefore, a decision to expand television does not mean that certain radio services should not also be expanded, or that radio should not be used as fully and efficiently as possible until television becomes available. Agricultural development officials have felt that All India Radio has needed more stations devoted to programming to meet local needs. One

possible strategy, therefore (to be considered in Chapter V), is that while India moves gradually into television it might at once add some radio stations to cover local needs that for a time cannot be met with television.

A second suggestion is that the cost of interconnecting stations for television might be greatly reduced by exchanging programs on videotape or film, rather than connecting the stations electronically. This is entirely possible, and some of it will doubtless be done even if electronic connection becomes possible. If school programs or general entertainment programs are to be exchanged, for example, there is relatively little need -- so far as program effect is concerned -- to do so by electronic means. The noncommercial educational stations of the United States have exchanged programs by mail for more than ten years, until recently they have been able to afford microwave interconnection on important occasions.

The experience of these American stations -- there are now 163 of them -- is instructive. They have established an elaborate system for duplicating programs, and scheduling them in different parts of the country. Thanks to the efficient U.S. postal service, the occasions when a station finds itself without the scheduled program are no longer frequent. But the eagerness which these 163 stations have shown in working toward microwave connection indicates that something is lacking even in the most efficient tape-exchange network.

For one thing, it is a cumbersome system. It hardly seems like a network, because the same program does not appear at the same hour, or even the same day or week, throughout the country. It would theoretically be possible to circulate a tape to each station for use at the same time everywhere, but this would require an enormous investment in tape and duplication, and exacerbate the already irksome problem of storing huge tape libraries. More important, a network that merely exchanges tape loses the impact of timeliness. It cannot broadcast an event, nationally, when it occurs. Any program that refers to current events runs the risk of being ludicrously out of date. It is almost impossible to operate a national news service with up-to-date pictures without electronic connection. In fact, it has been very hard for the noncommercial stations in the United States to give their viewers a sense of viewing a national network. The symbol NET, National Educational Television, has been very slow in catching public attention as a fourth network until it began recently to circulate some national public affairs programs by microwave.

It is more than likely that there will be some tape exchange -- especially of school programs -- even if India establishes satellite or microwave nationally, and there is no special reason why tape exchange should not be used for all programs in the early stages of expansion. Thus, like the wider use of radio, tape exchange is an alternative way of meeting needs and reducing costs in the expensive first years of a new system. It is a system component to be considered in Chapter V. But it is not a permanent solution to the problem of interconnecting a national network.

Technical base

For any kind of television, with or without satellites or aircraft transmission, India presents certain technical problems.

In the first place, only about 10 per cent of the villages have electric power. The figure was 53,400 villages in 1966, and the Fourth Plan proposes to extend power lines to about 57,000 more. Even in 1974, therefore, more than 80 per cent of the villages still may be without electricity. Naturally, too, power is available first to the closer and the larger settlements. Every town of more than 50,000 has electricity and most towns over 20,000 have it, whereas almost no remote villages under 2,500 have power. This fact is directly relevant to the need for solid state receivers, and for battery power or generators in hundreds of thousands of locations.

A second problem, and perhaps a critical one, is the need for locally produced receivers. To date virtually no television receivers have been produced commercially in India. All those now in use in Delhi were imported. Recently, a prototype set has been designed at the Institute for Electronics in Pilani, and two firms have been licensed to manufacture it. One of these firms estimates that, if the demand is there, they can produce 10,000 sets in 1969, and 100,000 per year within three or four years (personal communication from J. K. Electronics). But the fact remains that probably not many more than 500 receivers will have been manufactured in India by the end of 1968.

Still another technical problem is presented by the inadequacy of the present microwave service. This is not sufficient to carry television, nor is there such capacity in new microwave or long-line cables now being installed. The Fourth Plan anticipates adding about 8,500 kilometers of coaxial cable and an equal length of microwave service to what is now available. This will help telephone and telegraph service, but will not be useful for television unless additional capacity is provided.

An idea of the size of the telecommunication problem in India can be gathered from the fact that there is one telephone in the country for every 550 persons. To put these figures in perspective, recall that the United States has one telephone for every two persons.

On the positive side, transportation by rail between the larger towns is very good, and there is excellent air service between the large cities. It would be relatively easy, if desired, to exchange videotapes among stations in the major cities. The problem in transportation is to reach the villages. There are only about 283,000 miles of surfaced road in India -- about a quarter of a mile for every square mile of India's surface -- and perhaps half the villages cannot be reached by road at all (although visitors to rural India become accustomed to seeing buses riding over open fields). Inadequate roads seriously complicate the problem of maintaining receivers and getting field staffs to places where they are needed.

And finally, the electronics industry in India is weak. Radio receivers are being made, but, so far as we have been able to determine, transistors are not being produced within the country. This is unfortunate, considering the scarcity of electric power in villages.

On the other hand, some electrical appliances, bulbs and fluorescent tubes, batteries, air-conditioners, and other such devices are now made quite successfully in India. There is thus no reason why electronics should not be built up and why it could not in the long run be a viable part of the Indian economy. Indeed, the expansion of television might be a great incentive to the establishment of a productive and profitable electronics industry.

It is worthy of note that India has had atomic reactors since 1956. It now produces power and radio isotopes from different kinds of reactors, and conducts research on nuclear energy. There is a uranium metal plant and a plutonium plant in operation. Of some importance is the fact that some of the same persons who pioneered in this development of nuclear energy have now become interested in satellite television. Perhaps this is a good sign that the same drive may be applied to communication electronics.

The Department of Atomic Energy has built an experimental satellite communication earth station seven miles from Ahmedabad, where research is going on and students from India and other Asian countries are being trained in satellite communications technology. Another earth station for communication with the global intelsat network of satellites is under construction at Arvi, about 50 miles north of Poona and 120 miles east of Bombay. This station, when it becomes operational (probably some time in 1969) will hook India into international telephone and telegraph circuits by satellite.

Obviously, India can produce television receivers, transistors, power supplies, and maintenance facilities and technicians, if it sets itself to the task. Yet the weakness of the technical base is a major problem to be faced in any plan that includes rapid expansion of television.

Personnel base

Approximately 20 program personnel and 30 engineers now on the staff of All India Radio have been trained abroad in television production, although not all of them are now working in television. Several dozen more, both on the technical and program sides, have had substantial experience with television in the Delhi operation.

To staff 56 producing stations adequately (41 of them for limited one-studio production) would require, by Indian estimates, between 2,500 and 3,000 persons on the production and management side and perhaps 3,500 to 4,000 in the engineering area. All India Radio, for example, has estimated that for the five new stations tentatively provided for in the Fourth Plan, 478 additional skilled employees would have to be trained. About 50 of these, it is estimated, would have to be trained abroad. (AIR, An Informative Note, 1968, pp. 50-51.)

At the present time, there is no television training school in India. The AIR staff training school has for the past two years been assigned the task of television as well as sound broadcast training, but it has no facilities of its own, no cameras, VTRs, or telecine. It is hoped to provide these facilities in the future, but at the moment training for television consists mainly of on-the-job experience at the Delhi station, plus occasional workshops and courses.

Obviously, therefore, any swift expansion of television would create a serious need for trained personnel. Further, this need would be felt not only by the agency in charge of the television service, but also by the ministries and other offices that would want to make use of television in their development programs. A great deal of school and teacher-training material, agricultural information, family planning and health material, for example, would necessarily involve the agencies concerned with the substance of the material as well as television producers and engineers. Very few officials in any of these agencies currently have any familiarity with the use of television.

Introduction of television also would generate a substantial need for field staffs that would be asked to provide a framework for the use of television in the field -- to help teachers use it effectively, to organize village clubs and meetings around it, and to furnish the advice and logistical help required to translate some of the program suggestions into action. Of course, the village level workers would provide a nucleus of the staff needed for following up television broadcasts in the agricultural field, but another 20,000 to 40,000 or more would have to be added to their ranks if the ratio of one worker to every five or ten villages is maintained.

On the education side, a field staff would have to be built almost from scratch, perhaps using the experience gained at Delhi as a starting point. Here, too, we are talking about the need for several thousand field workers if the village schools are to receive frequent enough visits to do any good. If literacy is to be aided by television, if new teleclubs are to be formed for other purposes, then supervisors for these groups will have to be found and trained for their responsibilities.

Still another field staff will have to be provided for maintenance. The Indian representatives on the INCOSPAR - NASA planning group have estimated that it would require 33 men and 10 jeeps to service 4,200 sets, assuming that each set would require servicing on the average of six times a year. In practical terms, this means one automobile to every 420 sets and one maintenance man to every 130 sets. (Joint NASA/ Indian DAE Satellite ITV Experiment for India, 1968, p. 12.) The estimate seems low, especially if remote villages are to be served, and considering that there may be only one set per village. All India Radio estimates that for some situations 10 men will be required to service 100 sets, each in a different village. Thus, if the requirement is for roughly 600,000 receivers, we may be talking about a maintenance staff of some tens of thousands of technicians.

The importance of this one single item to the effectiveness of a national television system cannot be overstated. Experience in Africa, American Samoa, and India itself shows conclusively that provision for regular set maintenance is an essential part of any television program in a developing country. In India, for example, one of the most serious criticisms made of the farm program for the participating villages around Delhi is that normally 10 per cent of the sets are out of order, and up to 25 per cent are not functioning during the monsoon period. (Vepa, A Review of the Pilot Agricultural Television Project in Delhi, p. 2.)

Given India's many languages, still another personnel need for any effective television program would be for translation skills and for special language announcers and performers. The more that programming is centralized and shared widely across the nation, the more important these skills become. There are apparently relatively few people in India now experienced in simultaneous translation, let us say, for example, between Oriya and Marathi, or Hindi and Malayalam.

When television is used widely in schools, a very large number of teachers will need to receive in-service training in using the medium effectively. This number will be in the hundreds of thousands when television reaches even as much as 10 per cent of the schools.

From the foregoing, it is clear that an adequately staffed venture into national television would require the training of hundreds of thousands of persons, for different responsibilities and at different levels. Some of these (for example, classroom teachers), would need only some in-service training. Some members of the ministries concerned would need only a workshop to familiarize themselves with the opportunities and problems of television. Others (for example, some of the top program personnel) would need as much as a year or more of special training, and some of them would have to be trained overseas.

The implications are clear. If India intends to move substantially and effectively into television within the next few years, a broad training program should begin as soon as possible. The first step might be to send the prospective trainers abroad for experience in television so that they could return and organize training in India. No matter how soon the training program begins, it will be an effective limit on how fast the nation can move into television.

Control and organization

The creation of a national television service in support of education and national development raises certain special problems of control and organization.

For one thing, any organization charged with the responsibility of providing television service for the nation will necessarily be a large, expensive, and complex one. It will be an uneasy mixture of artists and engineers, educators and community workers. It will be in the public eye almost as much as any organization in the nation. It will have a very broad assignment, and will necessarily have to think about serving all segments of the society and all relevant branches of government. Any nation moving into national television, and especially satellite television, must consider whether its existing organization for broadcasting is adequate.

Two distinguished committees have recommended that television be separated from AIR and from the Ministry of Information and Broadcasting, and made a public corporation.

The Bhagavantam Committee, which reported in 1965, said that ideally broadcasting "should serve as a public service in the widest sense of the word, providing a free and unfettered flow of information, a platform for the free exchange of ideas and opinions of all kinds and from all sources, and a medium of entertainment which, while entertaining at a sustained level, should also be a stimulating source of education in music, literature, drama, and the arts.

"A Government Department could achieve this only in certain special circumstances. . . . A corporation, with a reasonable degree of autonomy built into its constitution, can function more independently and effectively in this context. In the highest concept of the Public Corporation, broadcasting would and should work as a trustee of the nation. Governments may come and go, but the policy of the Corporation will be guided primarily in the widest national interest. In some respects, such a liberal approach can be even more effective and useful to government than the purely Government controlled approach. But a Public Corporation, to be really effective, will have to be financially independent. If it has to depend on Government for its main revenue, there is certain to be checks and safeguards which will take away the freedom of the Corporation and the flexibility of its programme of action.

"In India, however, the position in respect to sound radio has been different in that it had a somewhat inhibited and chequered growth. Given a fresh start, television may be able to build up traditions, unfettered by the inhibitions of sound radio. We presume that the present intentions in India are to develop television, not as a medium of entertainment for the small well-to-do members of the community, but as an instrument of social education in the widest sense to reach urban and rural areas alike. In our opinion, a Public Corporation will have more flexibility and freedom in guiding its policies in regard to problems like recruitment, growth and planning in a rapidly changing social situation and in the light of rapidly changing technical developments." (Report of the Technical Committee on Television, 1965, pp. 12-14.)

The Chanda Committee of 1966 came to a similar conclusion: "It has to be considered," their report said, "whether it will be possible or wise to place television under the aegis of AIR. This possibility has to be ruled out as AIR is not organisationally and financially equipped to shoulder this responsibility. It would also be unfair to tag on television to AIR and expose it at its birth to prejudices which exist against AIR. On all these considerations, we should strongly advise against the development and management of this new medium, requiring a dynamic and imaginative approach and ample resources, being linked as an ancillary to an organisation which itself needs a major overhaul and refurbishing. We have been strengthened in this view by the opinion expressed by the Director General himself that television should be allowed to develop as a separate entity unfettered by the inhibitions of AIR.

"The question still remains whether the new organisation should follow the pattern of AIR and become an attached office of a Ministry or whether it should be made an autonomous corporation, created by a special statute of Parliament. Having carefully considered the question in all its aspects, we have come to the conclusion that to develop on correct lines television must not be hampered by the limitations of a department; it should have a broader outlook, greater flexibility and freedom of action which the corporate form alone can give. This view received near-unanimous support from the witnesses who appeared before us." (Radio and Television: Report of the Committee on Broadcasting and Information Media, 1966, p. 210.)

Thus, two committees composed of prominent Indian leaders believe it would unduly handicap national television to be controlled directly by a government ministry or to be organized as part of the existing broadcast service. It is for India, rather than outside observers, to react to these recommendations. But the broader implication is that India, or any other nation introducing such a television service, must consider carefully how best to free television to do a creative, effective job in the broad national interest while at the same time bringing into the operation all the agencies and individuals that must play a part.

A related question to be answered concerns commercial advertising and under what arrangement, if at all, it would be acceptable. All India Radio, for example, has begun to accept advertising in a part of its sound broadcasting service, but the question has had little discussion with respect to television.

Preparation

The implication of the preceding pages is that India, or any other country, will need considerable time to get ready for an effective national television service.

India has a long history of planning, of course. But it may be useful, nevertheless, to mention some of the kinds of planning and preparation that must precede such a large-scale developmental and educational television service as we have been discussing.

(a) A strategy of use must be developed. Decisions must be taken on priority objectives and audiences, and these must gain official approval and broad understanding. In India, there seems to be fairly general agreement that the place where television can make the most difference in the pace of development is in the village, where it can help in the modernizing of agriculture, family planning, literacy teaching, health programs, and general improvement of village life. There seems to be broad agreement also that it can help substantially by equalizing learning opportunities in schools, improving the quality of education, and strengthening science and technology in the schools so as to relate education more closely to the needs of employment and national productivity. But even when these broad objectives are agreed upon, a very large task remains in specifying sub-goals (e.g., what science? what grade level?) and determining priorities and relationships among them.

(b) A system strategy must be developed. The size and scope of the system must be decided upon in terms of all the requirements upon it and the resources available. One of the most important decisions is the pace of entering the system. How much television next year? the next five years? the next ten? how shall interconnection or exchange be handled? where shall receivers be placed at a given time? The needs for more stations, more receivers, more programming must be projected into the future, and balanced against the resources that are likely to be available.

(c) In light of what has been decided under (a) and (b), the needs in personnel, materiel, and money must be forecast in detail.

(d) In light of all these decisions, or together with them, basic decisions must be taken on how the new system shall be organized and controlled.

(e) A detailed schedule -- who must do what by when -- must be worked out.

(f) One part of this schedule will provide for the making of content plans, based upon the priority objectives and the configuration and scheduled expansion of the system. After the time is roughly divided by content and audience, then a series of activities must be set in motion to review content and curriculum, to prepare, to try out, and to stockpile programs.

(g) Hiring and training plans must be made. Employees must be selected for training, and training schools and workshops must be established. These activities will include engineers, technicians, producers, program writers, field staffs, television teachers, classroom teachers, and group monitors.

(h) Engineering and manufacturing plans must be made. New stations must be designed and built. A considerable range of electronic equipment must be manufactured or imported. In particular, the manufacture of receivers within India must be stepped up to the required level.

Arrangements must be made to provide power sources where they will be needed most, and receivers and antennae must be installed.

(i) As much time as possible must be allowed for practice -- "dry runs" -- with whatever equipment is to be used. This includes studio as well as transmitter practice, and the testing of programs.

(j) Budgets must be made and approved, and money obtained.

The above are by no means all of the considerations which must precede a national television service going on the air. However, they are at least indicative of the magnitude of the preparations necessary if the service is to be of any scope and significance. If the preparations are carried out adequately, they will take several years in India, and it is hard to think of any developing country where proper preparation will require much less time. World-wide, the experience has been that new countries "muddle into" television, especially that they allow far too little time to plan and prepare the program objectives and content. (For example, see the discussion in The New Media: Memo to Educational Planners, Unesco, 1967, chapters 3 and 5.) If inadequate preparation is dangerous and potentially disastrous in the case of one or two ground-based television stations, it is doubly so in the case of a satellite system.

Television questions and satellite questions

It is worth noting again that all the questions we have raised are not necessarily the result of deciding to use a television satellite, but rather of deciding to use television on a broad scale. Most of the considerations are no different whether television is delivered by satellite or without satellite. The possibility of using a satellite will add special dimensions to system decisions, and to decisions on strategy of use and strategy and pace of entering the system. But the considerations that most closely belong to the choice of a satellite are those that grow out of the unique ability of the satellite to deliver a television signal over a huge area, and out of the near-monopoly on some aspects of satellite technology held by a few industrially advanced countries.

Access to satellite technology

Only one nation has so far built and launched a synchronous satellite of the type recommended in all designs which have so far been submitted for India. Only a few nations have built a communication satellite of any kind, and only two nations presently have the capacity to orbit a large satellite. If India is to utilize a television satellite any time in the near future, it must obtain it from one of those nations and arrange for it to be launched, or else it must rent time on one of the satellites operated by Intelsat or another global system if another one comes into being.

Such action would seem simple enough, and there is no reason to believe that India could not arrange for construction and launching, or rental, according to its needs and wishes. Yet we have heard fears expressed in India that such an arrangement might result in loss of some of the control of the satellite and, consequently, of a major segment of the communication system. Who will control the jets that keep the satellite in orbit, some Indians have asked? What if the country that furnishes the satellite decides to take it back? Will the country that provides the satellite insist upon some control over what is broadcast? To be specific, what if India says something that another country considers unfriendly? What if India develops an unfriendly relationship with a nation friendly to, or allied with, the nation that furnished the satellite? What if India bases most of its national communication system on a space link, and then the link is taken away for political or other reasons?

Questions like these can be understood in terms of the sensitivity most nations feel about their internal communication systems. In the particular circumstance we are talking about, and in the present world situation, there would seem to be little danger that anything would happen to India's satellite. And yet the fact that these concerns do exist cannot be overlooked.

Coverage area and spill-over

The great advantage of a satellite -- and also the source of some of the concern about using it efficiently -- is the size of the area it can serve. A synchronous satellite at 22,300 miles can cover about one third of the earth if that is desired. The beam can be focused and compressed somewhat, and later types of satellite will be capable of focusing their beams very sharply and thus trading coverage for concentration of power. But because present satellites typically cover a very large signal area, they create two possible problems when used for a national program of education and development: (1) They may spill a signal over the national border into countries that might conceivably be sensitive about having it received on their territory, and (2) they must be programmed to serve an area that will represent many different needs and cultural contexts.

The first of these would not seem to be a matter of great concern in the situation of India. Although the signal from an Indian satellite would probably be receivable throughout Pakistan, Nepal, Ceylon, and parts of other neighboring countries, it would create no problem unless receivers in those countries could pick it up. If the satellite signal were delivered to India by rebroadcast from ground stations, then the problem would be no different from that of ground-based television. Spill-over signals from ground-based television have so far not caused a great amount of trouble even in the case of unfriendly neighbors, and there are various technical methods by which effective reception in the neighboring country can be minimized.

Direct broadcasting from the satellite to home, village, or school receivers may cause a more difficult problem. International lawyers have been concerned about this matter, and some of their reasons for being concerned may be found in the proceedings of the Unesco conference on Communication and the Space Age (in the volume by that name published by Unesco, Paris, in 1968), especially the papers by Eek on "International Cooperation and International Control" (pp. 160-168) and Terrou on "The Need for International Agreements" (169-180). However, it must be pointed out that for the foreseeable future direct broadcasting from a satellite will require a special antenna (probably something of the order of a ten-foot dish) and a specially augmented receiver. There is no secret about this technology, and in theory any person within the signal range could equip his receiver with it. But on the other hand, if Country A does not want its people to receive the satellite signal from Country B, all it has to do is to prohibit the installation of the necessary special equipment. Thus this problem, like the other one, would seem not to be specially bothersome for India at the present time. If the time comes when such augmented receivers are in general use, or when satellite signals are so powerful that no special equipment is required, then some kind of international agreements or control will probably be necessary.

The problem of heterogeneity

The most serious consideration which the possibility of a satellite would force upon India is the question of whether a central broadcasting instrument of this kind could be adapted to the heterogeneity of the country.

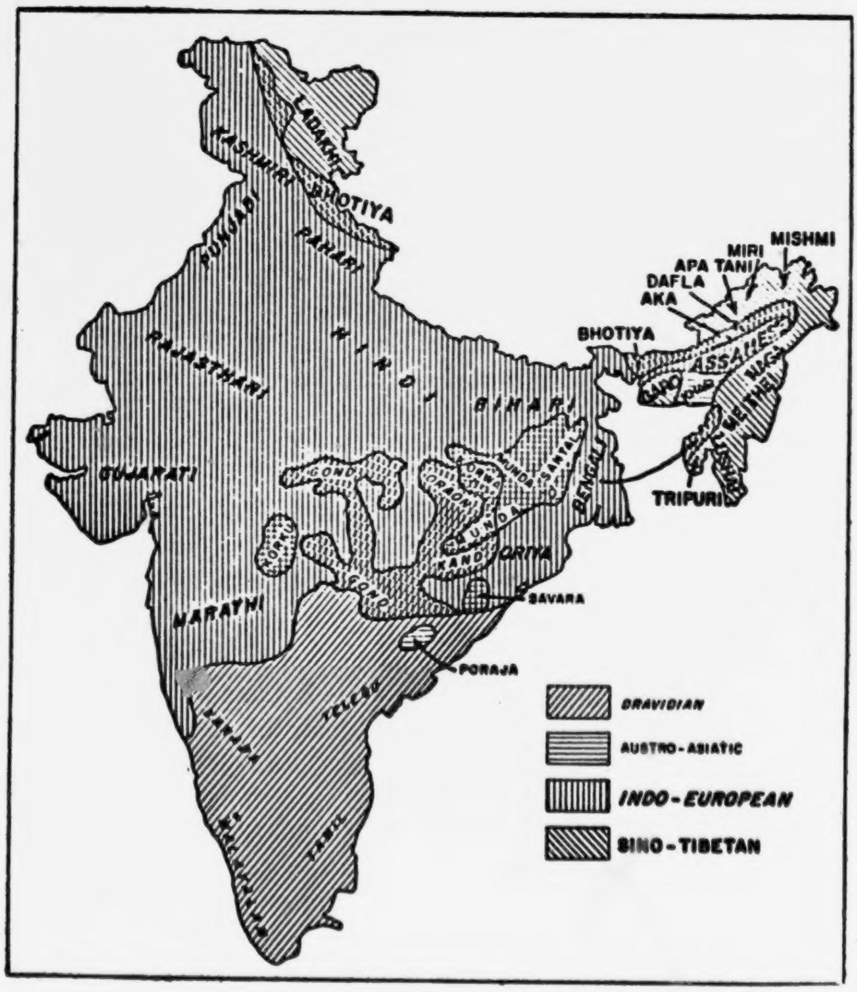
The heterogeneity of India is indeed formidable. There are 15 official languages, thirteen of them spoken by more than 10 million people each. The smallest of these linguistic groups is larger than two thirds of the countries of the world. Sixteen unofficial Indian languages are spoken by more than half a million people each and 19 others by more than 100,000 but less than half a million. Altogether, there are over 800 recognized languages in India.

Furthermore, many Indians have an extraordinary degree of psychological identification with their language, and consequently with their regions. Trains are burned in the south of India because they have Hindi words painted on the coaches. Legislators walk out in certain states of northern India when a representative of the Union government does not speak to them in their official tongue. People riot over decisions on language. And the situation seems to be growing worse, not better, as universities turn to regional languages instead of English for their instruction.

Cultural groups in India are equally diverse. The chief ones are the Dravidian peoples in the south, and the Aryan peoples in the north. But there are also numerous pockets of Austrec people, and many Sino-Tibetan cultures in the mountains of the north. About 15 per cent of the people belong to the scheduled castes, and 7 per cent to the scheduled tribes, which the Constitution singles out for special consideration even to reserving legislative seats for them.

Moreover, there are 17 states -- most of them more clearly aware of their differences than are the states of the United States -- and 13 Union Territories, including the capital city of Delhi. There are 23 listed political parties, including the dominant Congress Party of Gandhi and Nehru. Among the others are several varieties of Communists, the Swatantra Socialists, and the right wing Jan Sangh. In recent years these parties have grown strong enough to challenge the Congress successfully in a number of states. Although 84 per cent of the people are affiliated with the Hindu religion, there are vigorous minorities including 11 per cent who are Muslims, 2 per cent Sikhs, 2 per cent

Principal Language Families of India

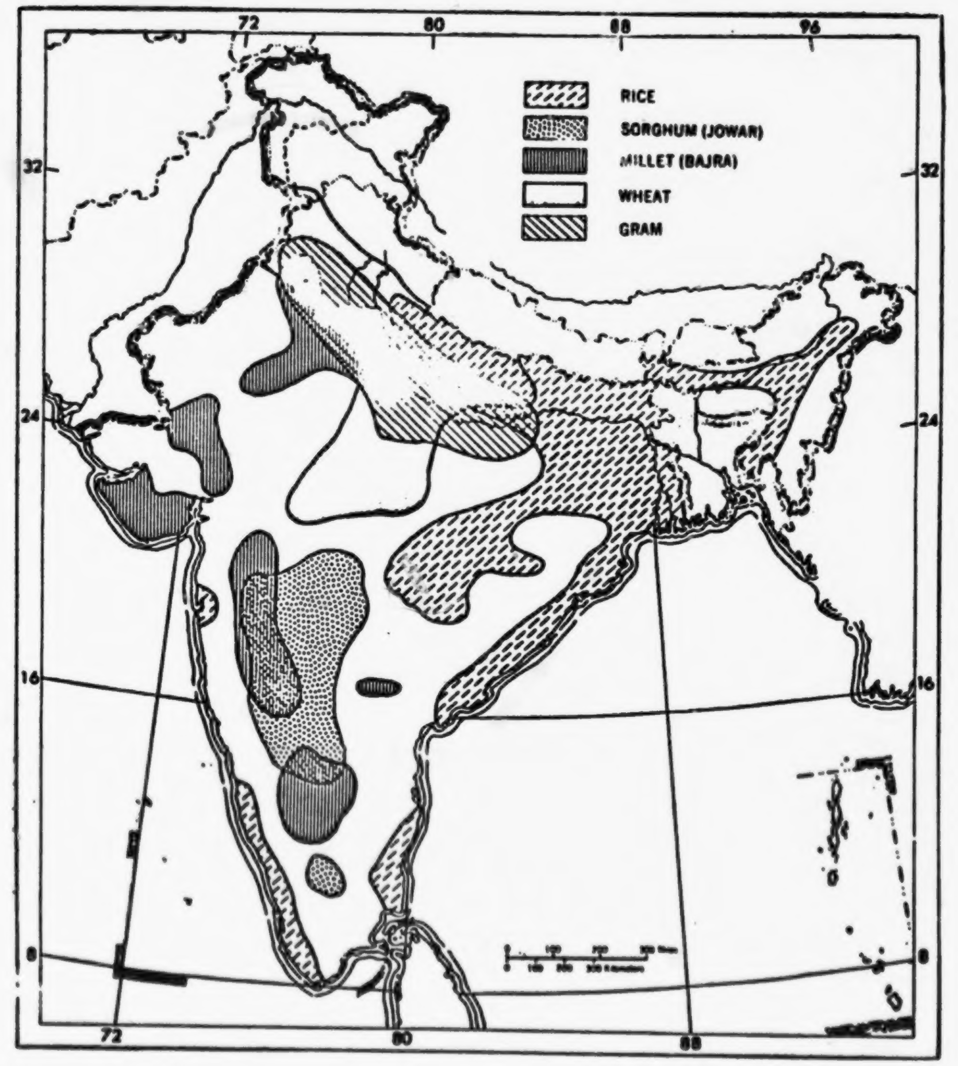


Source: Adapted by The Army Handbook (1964) from V. K. Narasimhan, et al., eds., The Languages of India -- A Kaleidoscopic Survey, 1958; and American Geographical Society, India: A Compendium, 1962, pp. 130-131.

Christians, and smaller numbers belonging to the Buddhist and Jain groups.

It is commonly said that there are 86 agricultural areas in India, each with different needs for information. About 22 per cent of the cropped area of the nation is planted in rice, 9 per cent in wheat. The rice is mostly on the coastal plains, the wheat on the northern plains. Much cotton is grown in the west central parts of the country, and large quantities of other food crops such as sorghum, millet, chick peas, peanuts, and corn are raised throughout the center of the country. Livestock are raised at widely dispersed areas. There are estimated to be 176 million cattle in India, and 51 million buffalo used for farm work, milk, and in some areas meat. There are 61 million goats, 40 million sheep, large numbers of poultry, and some camels. The annual catch of fish is about 1.4 million tons. About 22 per cent of the country is in forests.

Consequently the needs for agricultural information differ throughout the country. Because most farm plots are small, the average farmer does not practice diversification in his main crops. The wheat farmer does not need the information that goes to a rice farmer; a dry farmer does not need to know about irrigation; a livestock raiser does not need to know about the care of forests. To make the heterogeneity problem worse, agricultural regions are not coterminous with language regions. Rice growers, for example, will speak Assamese, Bengali, Oriya, Tamil, Telegu, Malayalam, Kannada, Marathi, and doubtless many other languages.



Major Cereal Crops of India.

Source: The Army Handbook, 1964.

The school system is equally diversified. The language of instruction is the language of the region. Primary, middle, and secondary education are the responsibility of the individual states, and 57 per cent of the educational expenditure comes from them as compared to 10 per cent from Union funds. Naturally, this means that curricula and schedules will differ from state to state, despite what the central government does to maintain some equality of standards. Even within the states there are great differences in quality and content.

The very number of schools itself presents a problem of preparing them to use a central television service. There are approximately 500,000 schools in India, 70 universities, 1,764 colleges, 206 teacher-training colleges and 1,647 teacher-training schools at the secondary level, 3,208 pre-primary schools, and a smaller number of specialized schools in such fields as commerce and physical education.

The essence of education in India, as in the United States, is localness. Whatever the central government contributes or requires is grafted on a base of local control, local culture, local needs, and local languages.

This situation illustrates both the strength and the weakness of an educational and developmental satellite: Its great ability to deliver the same signal to an enormous area must be balanced against the needs of localness. India's problem in this regard is perhaps the world's most difficult. Certainly it is far more complex than that of Canada, for example, which also has plans for a national satellite but which has only two principal languages and much less cultural diversity, or of Indonesia which has but a single national language. Compared to the Latin American countries, India's political difficulties would be less but the linguistic ones far greater.

Can a satellite system be so designed and used as to meet the demands of such a heterogeneous audience without losing most of the value of nation-wide program distribution? This is the central consideration in deciding upon a satellite for India. Most of the leaders of India who have been thinking about satellite plans believe that the answer is yes. The Unesco team concluded that it could be done, and suggested certain methods that might be used: multiple-sound channels, repetition of programs in different languages, commentaries in different languages, dubbing of languages at regional points, subtitles in different languages, and simultaneous translation. (Unesco report, COM/WS/51, p. 26.)

Nevertheless, some of the implications of this conflict between heterogeneity and broad coverage from a central source must be noted.

Whatever is done, some of the contribution of central broadcasting to national unity is certain to be diluted by the different needs and requirements of the national audience. The time available for any one language, any one culture, any one information-using group in any region, must of necessity be reduced over what it would be, for example, in a one- or two-language country. Naturally, this situation would be greatly ameliorated if India were to decide upon one or two official languages for everyone. But this goal appears far in the future, if indeed it is achievable at all. Even if it does come to pass, there will remain important cultural difference of importance. Indians are asking, however, whether the very existence of a powerful national instrument such as satellite television, particularly if the programming is well done and receivers are widely available, may not tend to encourage the movement toward a national language, or a few national languages, and also help to break down cultural barriers.

It goes without saying that if the heterogeneity problem is to be solved, it will require that a high degree of ingenuity be applied to the design of the space link and the programming of the system so that the best balance between centrality and heterogeneity can be achieved. For example, it would seem highly desirable ultimately to have several video channels in the satellite, and two or more voice channels for each video, if these objectives can be achieved without sacrificing too much power. With two video channels, the time available to any one audience could be doubled. If there were twice as many voice channels as video, the time available to each language group would be doubled again.

In the program schedule, a corresponding degree of ingenuity will be required. For example, what proportion of wheat farmers understand Hindi? How many could get along with a picture and subtitles or brief oral explanation in one or more languages other than Hindi? What is the best mix of languages for programs on rice farming? How many times, and at what hours, and in what languages, would it be most efficient to repeat in-service programs for teachers? In covering national events live, how much audience would be lost if commentaries were provided in, let us say, only five languages -- Hindi, Marathi, Bengali, Telugu and Tamil -- with subtitles or occasional explanations in other languages? What could be done toward teaching one or two common languages by using them for entertainment programs or offering televised courses in them?

Beyond the obvious need for ingenuity and multiple channels, the situation has certain other implications for system design and use.

For one thing, the great variety of programming and language skills required would seem to suggest the value of having more than one program source. One obvious point of origin, in addition to the program center at the ground station itself, would be in Delhi where the central government is located and where events and personalities related to it can be covered. A second program source might well be Bombay, where there is the highest concentration of film talent. A third might be located in the south of India, perhaps at Madras, where there is another concentration of film talent. Calcutta might offer a fourth possibility as a program center. These four centers would represent, incidentally, four of the largest linguistic groups.

Again, the heterogeneity and localness of need point to the desirability of orginating and broadcasting some of the programs in and for specific regions. For example, if there were perhaps six to 15 ground-based transmitters scattered over the country, with facilities to program and to store programs on videotape, then they could furnish some of the programs required for their region, and at a later time feed translator stations in order to carry these same programs to a wider area. In addition, the satellite could be used in non-broadcast hours to feed programs to videotape machines in the regional centers for later broadcast, thus multiplying the usefulness of the central program source, as well as providing an opportunity for the regional station to add a commentary in the language of that area.

Finally, the situation points strongly to the usefulness of beginning with a relatively small service, to a few regions in a few languages, and learning how to manage that kind of problem before launching into a more complex system.

What kind of programming would be possible?

The test of how useful a satellite will be, in a situation as heterogeneous as India's, is the kind of programming it will be possible to do on the satellite channels.

To get some idea what this would be, we have sketched out sample program schedules as they might be for the pilot project, when a single-channel satellite would be in use, and at a later stage of development when India might have a satellite with three channels. There is no magic about these numbers: It might be possible to have two channels even during the pilot project, and ultimately satellites will become available with many more than three channels. But these examples will illustrate what would be possible at two points of system expansion.

Of course, these are hypothetical program schedules only. They are not intended to be definitive, and certainly not to guide the actual programming that will be done in India. Even if India needed any help in programming its satellite, realistic help could not come from this distance without a great deal more information than we have at hand. The number of languages, kinds and timing of courses, grade levels, division of general service time, and similar matters will be decided by Indian content experts in cooperation with the program staff itself. What we have done is merely by way of illustration.

Let us begin with the assumption that a pilot satellite will be available with one video and two audio channels. Let us further assume that the experimental objectives of the pilot project could be met by programming in four languages, and that time should be divided relatively equally among these languages. If this were the case, for example, the four languages might be chosen from among Hindi, Telugu, Bengali, Tamil, Marathi, and Gujarati.

We have arbitrarily divided the television day as follows:

9:25 a.m. - 2:00 p.m. -- school broadcasts
3:00 - 4:00 -- teacher training
4:00 - 5:00 -- vocational education (for young people soon to enter the labor force, or workers requiring refresher or self-improvement courses)
5:00 - 6:00 -- literacy teaching
6:00 - 6:45 -- children's programs
6:45 - 7:45 -- national news and public events
7:45 - 8:30 -- village life (programs on agriculture, health, family planning, and community development)
8:30 - 9:45 -- cultural and entertainment programs
9:45 - 10:15 -- news recap

This is a relatively full schedule, of course, and we doubt that it would be possible at once to program a pilot satellite so extensively. But the schedules illustrate what could be done with one channel, serving four language groups.

Let us begin with the school broadcasts. We have based the program on AIR's present Delhi pattern of school service: science, language, and social studies. We have carried these same three subjects through five grades (without specifying what grades), with three 15-minute television broadcasts in science and language, and two in social studies, for each grade per week. In accordance with best practice elsewhere, it is assumed that these 15-minute broadcasts would be preceded by a classroom introduction and followed by classroom discussion and/or practice on the topic. We have provided a five-minute break between broadcasts, and have so planned the schedule that no one language group would have consecutive broadcasts. Thus there should be plentiful opportunity to plan activities around the broadcast, and to move different classes in front of the receiver without too much disruption.

In the illustrative schedule that follows, we have referred to the level of the subjects by Roman numerals (e.g., Science I), and the languages by capital letters (e.g., Language A might be Hindi, Language B, Tamil, and so forth). Here is the hypothetical schedule for a school day:

Schedule A
Hypothetical Schedule - Channel One
Programming for One Video - Two Audio Channel Satellite School Service

Hour	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
9:25 - 9:40	Science I Lang. A & B	Language I Lang. A & B	Science I Lang. A & B	Language I Lang. A & B	Science I Lang. A & B	Language I Lang. A & B	
9:45 - 10:00	Language I Lang. C & D	Science I Lang. C & D	Language I Lang. C & D	Science I Lang. C & D	Language I Lang. C & D	Science I Lang. C & D	
10:05 - 10:20	Science II Lang. A & B	Language II Lang. A & B	Science II Lang. A & B	Language II Lang. A & B	Science II Lang. A & B	Language II Lang. A & B	
10:25 - 10:40	Language II Lang. C & D	Science II Lang. C & D	Language II Lang. C & D	Science II Lang. C & D	Language II Lang. C & D	Science II Lang. C & D	
10:45 - 11:00	Science III Lang. A & B	Language III Lang. A & B	Science III Lang. A & B	Language III Lang. A & B	Science III Lang. A & B	Language III Lang. A & B	
11:05 - 11:20	Language III Lang. C & D	Science III Lang. C & D	Language III Lang. C & D	Science III Lang. C & D	Language III Lang. C & D	Science III Lang. C & D	
11:25 - 11:40	Science IV Lang. A & B	Language IV Lang. A & B	Science IV Lang. A & B	Language IV Lang. A & B	Science IV Lang. A & B	Language IV Lang. A & B	
11:45 - 12:00	Language IV Lang. C & D	Science IV Lang. C & D	Language IV Lang. C & D	Science IV Lang. C & D	Language IV Lang. C & D	Science IV Lang. C & D	
12:05 - 12:20	Science V Lang. A & B	Soc. Studies I Lang. A & B	Science V Lang. A & B	Soc. Studies I Lang. A & B	Science V Lang. A & B		
12:25 - 12:40	Science V Lang. C & D	Soc. Studies I Lang. C & D	Science V Lang. C & D	Soc. Studies I Lang. C & D	Science V Lang. C & D		
12:45 - 1:00	Language V Lang. A & B	Soc. Studies II Lang. A & B	Language V Lang. A & B	Soc. Studies II Lang. A & B	Language V Lang. A & B		

(Continued)

Schedule A
Hypothetical Schedule - Channel One
Programming for One Video - Two Audio Channel Satellite
School Service

Hour	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
1:05 - 1:20	Language V Lang. C & D	Soc. Studies II Lang. C & D	Language V Lang. C & D	Soc. Studies II Lang. C & D	Language V Lang. C & D		
1:25 - 1:40	S. Studies IV Lang. A & B	S. Studies III Lang. A & B	Education News - Lang. A	S. Studies III Lang. A & B	S. Studies IV Lang. A & B		
1:45 - 2:00	S. Studies IV Lang. C & D	S. Studies III Lang. C & D	Ed. News Lang. C & D	S. Studies III Lang. C & D	S. Studies IV Lang. C & D		

What would this kind of operation require of the programmers and producers? It would mean that each program would have to be done in two, or perhaps in four, languages. With videotape, it would be a relatively simple technical process to provide new sound tracks, and the only worry would be lip synchronization. If it proved bothersome to have lip movements out of sync with sound, as it might in the language programs, then it would be necessary to cut the amount of language programming in two or provide additional time for it. As the schedule is now drawn, however, the school program staff would have to produce at least 40 15-minute programs a week, with four times that many sound tracks.

What would it mean for the schools? It is evident that, with this much capacity divided among four languages, there is no chance to teach the core of an entire 11- or 12-grade curriculum, as is done in American Samoa, Hagerstown, and certain other places. It would be necessary to concentrate on certain subjects in certain grades. This would fit Indian style and expectations perhaps better than the full curriculum, however. It is entirely possible that the decision might be to concentrate on science and mathematics for middle and secondary school, on the theory that these would do most to turn the curriculum toward employment needs. Or it might be that the teaching of a second language would receive top priority. But, in any case, in each of four different-language-speaking areas of India, it would be possible to provide 40 fifteen-minute periods of televised instruction per week, to be assigned according to educational needs as determined by educational leaders.

This would not be as salutary as to have the entire school day available for each language group, but it would make an impact.

Let us now look at a hypothetical schedule for the out-of-school broadcasts. Here, again, we have not labored under the illusion that our program schedule will bear any resemblance to the programs India finally decides upon: It is merely illustrative. We have assumed that it is desired to cover four languages, and that programs should focus on high-priority objectives as articulated by Indian leaders: building national unity, providing family planning and health information, improving agricultural practice, raising the standard of literacy, upgrading the competency of teachers, and providing instruction in vocational subjects outside school hours.

Here is our suggestion as to one way the schedule could be put together:

Schedule A
Hypothetical Schedule - Channel One
Programming for One Video - Two Audio Channel Satellite
General Service

Hour	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
3:00 - 4:00	Teacher Train. Lang. A & B	Teacher Train. Lang. C & D	Teacher Train. Lang. A & B	Teacher Train. Lang. C & D	Teacher Train. Lang. A & B	Teacher Train. Lang. C & D	
4:00 - 5:00	Vocational Ed. Lang. C & D	Vocational Ed. Lang. A & B	Vocational Ed. Lang. C & D	Vocational Ed. Lang. A & B	Vocational Ed. Lang. C & D	Vocational Ed. Lang. A & B	
5:00 - 6:00	Literacy Lang. A & B	Literacy Lang. C & D	Literacy Lang. A & B	Literacy Lang. C & D	Literacy Lang. A & B	Literacy Lang. C & D	
6:00 - 6:45	Children's Program Lang. C & D	Children's Program Lang. A & B	Children's Program Lang. C & D	Children's Program Lang. A & B	Children's Program Lang. C & D	Children's Program Lang. A & B	Family Program Lang. A & B
6:45 - 7:15	National News & Public Events Lang. A & B	Nat. News & Public Events Lang. C & D	Nat. News & Public Events Lang. A & B	Nat. News & Public Events Lang. C & D	Nat. News & Public Events Lang. A & B	Nat. News & Public Events Lang. C & D	Family Program Lang. C & D
7:15 - 7:45	National News Public Events Lang. C & D	National News Public Events Lang. A & B	National News Public Events Lang. C & D	National News Public Events Lang. A & B	National News Public Events Lang. C & D	National News Public Events Lang. A & B	Cultural and Entertainment English Lang.
7:45 - 8:30	Village Life... Agriculture, health, family planning Lang. A & B	Village Life... Agriculture, health, family planning Lang. C & D	Village Life... Agriculture, health, family planning Lang. A & B	Village Life... Agriculture, health, family planning Lang. C & D	Village Life... Agriculture, health, family planning Lang. A & B	Village Life... Agriculture health, family planning Lang. C & D	Cultural and Entertainment English Lang.
8:30 - 9:45	Cultural and Entertainment Lang. C & D	Cultural and Entertainment Lang. A & B	Cultural and Entertainment Lang. C & D	Cultural and Entertainment Lang. A & B	Cultural and Entertainment Lang. C & D	Cultural and Entertainment Lang. A & B	Nat. News and Public Events Wk. Roundup 10 p.m.
9:45 - 10:15	News Recap Lang. A&B 15m. Lang. C&D 15m.	News Recap Lang. C&D 15m. Lang. A&B 15m.	News Recap Lang. A&B 15m. Lang. C&D 15m.	News Recap Lang. C&D 15m. Lang. A&B 15m.	News Recap Lang. A&B 15m. Lang. C&D 15m.	News Recap Lang. C&D 15m. Lang. A&B 15m.	Lang. A&B 45m. Lang. C&D 45m.

In this case, also, the program staff would be faced with the need to provide multiple language tracks, though not so many as in the school programs, and in a situation where lip sync might be less important.

Note that the hours from 3:00 to 6:00 would be for special interest groups, meeting in classes or monitored study groups. Beginning with 6:00 p.m., each language group would have alternate evenings for cultural and entertainment programming -- thus, for example, on the "entertainment" evenings:

6:00 - 6:45 -- children's program
6:45 - 7:15 -- national news and public events
8:30 - 9:45 -- cultural and entertainment programs
9:45 - 10:00 -- news recap

On the other three weekday evenings, the programming would focus on village life, thus:

7:15 - 7:45 -- national news and public events
7:45 - 8:30 -- village life program on agriculture, health, family planning, etc.
9:45 - 10:00 -- news recap

A television evening with pauses for something other than commercials may seem strange to us, but in the Indian situation it would not be so bad. After the village life program, there would be a period for the teleclubs to meet, and discuss what they have heard. Before the entertainment period, there would be a time to gather and talk, as villagers love to do on any excuse. And during the times when the local language is not programmed, there would still be some temptation to watch the picture tube and listen to an unfamiliar language. Is it too much to hope that the presence of these other languages might lead more Indians to learn a second language?

We suspect that in actual practice a programmer might seek to enliven this program schedule, for example by doing something different with the after-school hours on Saturday. He might, for one thing, want to broadcast some sports of wide interest on Saturday, or a movie, or a report on the art, culture, and politics of one of the States. There are many interesting variations that any imaginative broadcaster would think of. We have merely shown some straightforward and fairly serious programming.

Now let us look at the situation that might occur if a satellite with three video and six audio channels were to become available, as could happen five or ten years into the program. In sketching out illustrative program patterns for this satellite, we have made the same assumptions as before.

By planning for a longer school day (which might be accomplished by some schedule overlap) we have been able to find room to program five years of mathematics along with the three subjects included in the pilot project programs. Thus it would be possible to offer, in each of 12 languages, five years of science, language, and mathematics, and three years of social studies.

Of course, this is only one option. We could furnish this amount of service (which adds up to 12 hours of 45 minutes of school broadcast time a week) for each of 12 language groups. These might be, perhaps, Hindi, Telugu, Bengali, Marathi, Tamil, Gujarati, Kannada, Malayalam, Oriya, Punjabi, Assamese, and Kashmiri. Or we might use two channels to provide the bulk of a curriculum in two languages (for example, four subjects for each of the last six years, and two or three subjects for the first five years), and divide the other time along special needs in other language groups. If it became possible to offer secondary school indstruction throughout India in one or two languages, then this would leave more time available for multi-language programming at the lower levels. It might be decided that a certain number of home-study courses at the level of higher education should be included. These options would all be open. The point is that a satellite of this kind would offer something over 150 hours of usable school broadcast time to be scheduled according to whatever pattern was felt to be most desirable.

Here is a hypothetical schedule for school broadcasts on the larger satellite:

Schedule B
Hypothetical Schedule - Channel One
Programming for Three Video - Six Audio Channel Satellite
School Service

Hour	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
9:05 - 9:20	Science I Lang. A & B	Science I Lang. C & D	Science I Lang. A & B	Science I Lang. C & D	Science I Lang. A & B	Science I Lang. C & D	
9:25 - 9:40	Language II Lang. C & D	Language II Lang. A & B	Language II Lang. C & D	Language II Lang. A & B	Language II Lang. C & D	Language II Lang. A & B	
9:40 - 10:00	Math III Lang. A & B	Math III Lang. C & D	Math III Lang. A & B	Math III Lang. C & D	Math III Lang. A & B	Math III Lang. C & D	
10:05 - 10:20	Science II Lang. C & D	Science II Lang. A & B	Science II Lang. C & D	Science II Lang. A & B	Science II Lang. C & D	Science II Lang. A & B	
10:25 - 10:40	Language I Lang. A & B	Language I Lang. C & D	Language I Lang. A & B	Language I Lang. C & D	Language I Lang. A & B	Language I Lang. C & D	
10:45 - 11:00	Math II Lang. C & D	Math II Lang. A & B	Math II Lang. C & D	Math II Lang. A & B	Math II Lang. C & D	Math II Lang. A & B	
11:05 - 11:20	Science III Lang. A & B	Science III Lang. C & D	Science III Lang. A & B	Science III Lang. C & D	Science III Lang. A & B	Science III Lang. C & D	
11:25 - 11:40	Math I Lang. C & D	Math I Lang. A & B	Math I Lang. C & D	Math I Lang. A & B	Math I Lang. C & D	Math I Lang. A & B	
11:45 - 12:00	Language III Lang. A & B	Language III Lang. C & D	Language III Lang. A & B	Language III Lang. C & D	Language III Lang. A & B	Language III Lang. C & D	
12:05 - 12:20	Science IV Lang. C & D	Science IV Lang. A & B	Science IV Lang. C & D	Science IV Lang. A & B	Science IV Lang. C & D	Science IV Lang. A & B	
12:25 - 12:40	Language V Lang. A & B	Math V Lang. C & D	Language V Lang. A & B	Math V Lang. C & D	Language V Lang. A & B		
12:45 - 1:00	Language V Lang. C & D	Soc. Studies I Lang. A & B	Language V Lang. C & D	Soc. Studies I Lang. A & B	Language V Lang. C & D		

(Continued)

Schedule B
Hypothetical Schedule - Channel One
Programming for Three Video - Six Audio Channel Satellite School Service

Hour	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
1:05 - 1:20	Math IV Lang. A & B	Math V Lang. C & D	Math IV Lang. A & B	Math V Lang. A & B	Math IV Lang. A & B		
1:25 - 1:40	Math IV Lang. C & D	Soc. Studies I Lang. C & D	Math IV Lang. C & D	Soc. Studies I Lang. C & D	Math IV Lang. C & D		
1:45 - 2:00	Math V Lang. A & B	Soc. Studies II Lang. A & B	Math V Lang. A & B	Soc. Studies II Lang. A & B	Math V Lang. A & B		
2:05 - 2:20	Math V Lang. C & D	Soc. Studies II Lang. C & D	Math V Lang. C & D	Soc. Studies II Lang. C & D	Math V Lang. C & D		
2:25 - 2:40	Language IV Lang. A & B	Soc. Studies III Lang. A & B	Language IV Lang. A & B	Soc. Studies III Lang. A & B	Language IV Lang. A & B		
2:45 - 3:00	Language IV Lang. C & D	Soc. Studies III Lang. C & D	Language IV Lang. C & D	Soc. Studies III Lang. C & D	Language IV Lang. C & D		

Channel Two would be the same, with languages E, F, G, and H substituted for A, B, C, and D. Channel Three would substitute languages I, J, K, and L.

This sort of schedule would require a great amount of programming, and many language skills. It would be desirable, therefore, when more languages and more areas are served, to have additional production centers throughout India that would prepare programs in their own languages and for the areas they know best, and either transmit these programs directly to the satellite or deliver them to the satellite earth station by microwave or tape. These centers should be, at the least, at Delhi, Bombay, Calcutta, and Madras -- perhaps elsewhere also.

Let us now look at a possible schedule for the after-school hours, using the larger satellite.

Schedule B
Hypothetical Schedule - Channel One
Programming for Three Video - Six Audio Channel Satellite
General Service

Hour	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
3:00 - 4:00	Teacher Training Lang. A & B	Teacher Train. Lang. C & D	Teacher Train. Lang. A & B	Teacher Train. Lang. C & D	Teacher Train. Lang. A & B	Teacher Train. Lang. C & D	
4:00 - 5:00	Vocational Ed. Lang. A & B	Vocational Ed. Lang. C & D	Vocational Ed. Lang. A & B	Vocational Ed. Lang. C & D	Vocational Ed. Lang. A & B	Vocational Ed. Lang. C & D	
5:00 - 6:00	Literacy Lang. A & B	Literacy Lang. C & D	Literacy Lang. A & B	Literacy Lang. C & D	Literacy Lang. A & B	Literacy Lang. C & D	
6:00 - 6:45	Children's Prog. Lang. A & B	Children's Lang. C & D	Children's Lang. A & B	Children's Lang. C & D	Children's Lang. A & B	Children's Lang. C & D	Family Program Lang. A & B
6:45 - 7:30	National News & Public Events Lang. C & D	Nat. News & Public Events Lang. A & B	Nat. News & Public Events Lang. C & D	Nat. News & Public Events Lang. A & B	Nat. News & Public Events Lang. C & D	Nat. News & Public Events Lang. C & D	Family Program Lang. C & D
7:30 - 8:30	Village Life... Agriculture, health, family planning Lang. A & B	Village Life... Agriculture, health, family planning Lang. C & D	Village Life... Agriculture, health, family planning Lang. A & B	Village Life... Agriculture, health, family planning Lang. C & D	Village Life... Agriculture, health, family planning Lang. A & B	Village Life Agriculture, health, family planning Lang. C & D	Cultural and Entertainment English Lang.
8:30 - 9:45	Cultural and Entertainment Lang. A & B	Cultural and Entertainment Lang. C & D	Cultural and Entertainment Lang. A & B	Cultural and Entertainment Lang. C & D	Cultural and Entertainment Lang. A & B	Cultural and Entertainment Lang. C & D	National News and Pub. Events Wk. Roundup... to 10 p.m. 45 min. A & B 45 min. C & D
9:45 - 10:15	National & Local News Roundup Lang. A & B (15m) Lang. C & D "	Nat. & Local News Roundup Lang. C&D (15m) Lang. A&B "	Nat. & Local News Roundup Lang. A&B (15m) Lang. C&D "	Nat. & Local News Roundup Lang. C&D (15m) Lang. A&B "	Nat. & Local News Roundup Lang. A&B (15m) Lang. C&D "	Nat. & Local News Roundup Lang. C&D(15m) Lang. A&B "	

As in the case of the school broadcasts, Channel Two would be like Channel One except with languages E, F, G, and H, and Channel Three would carry languages I, J, K, and L.

The evening program we have sketched out is much like the pilot project evening schedule, but multiplied by three to take care of the eight additional languages. This general service would operate from 3:00 to 10:15 p.m., except on Sundays, when it would be on from 6:00 to 10:00. It would provide, for each of 12 languages -- if the programmers chose to use it that way --

3 hours of teacher training
3 hours of vocational classes
3 hours of literacy classes
3 hours, 45 minutes of news and public events
2 hours, 15 minutes of children's programming
3 hours of village life programs (agriculture, health, family planning)
3 hours, 45 minutes of cultural and entertainment programming
45 minutes of a program intended for the whole family

-- in addition to 1 hour and 15 minutes of cultural programming in English.

This adds up to 22:30 in each language (plus the English). The school time was 12:45. Thus, the satellite could furnish a little over 35 hours per week to each of 12 language groups.

This is not so impressive as the service that could be rendered if

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only one language or two had to be programmed. But it is clearly a significant amount of service, and in the villages of India it would be enough to have an enormous potential impact.

Two further notes. For one thing, it may be supposed that by the time an advanced satellite of this type were in use, there would be also a certain number of local ground-based stations, transmitting in their regional languages. If so, these stations could rebroadcast part of the national service and fill in the pauses (for the other languages) with local programs.

In the second place, it is worth noting that even with the program schedule we have outlined, the satellite would be out of use for more than 10 hours a day. Those hours could be used for telecommunications, for transmitting programs to be recorded on videotape for local broadcast, or for such other purposes as seemed appropriate.

Summary, and a preliminary conclusion

This chapter ends on a very encouraging note. If a satellite with one video channel and two audio channels can be programmed to furnish 35 hours of broadcast time per week to each of four language groups, and a satellite with three video and six audio channels can similarly serve 12 language groups, then there is every reason to believe that heterogeneity is not an insoluble problem for nations that want to use a satellite in support of education and development.

More than 12 hours school broadcast time per week, 3 hours teacher training, 3 hours for literacy training, 3 hours for vocational training after school hours, nearly 4 hours of news, and about 10 hours of general service -- this is enough to make a significant difference in the information input to any language group. Providing an answer to the problem of linguistic diversity of course does not solve all the problems of heterogeneity. But the language problem is the most troublesome one. If it can be handled, then there is good reason to hope that skillful programming can also meet the needs of agricultural diversity and educational differences, which are less troublesome. There is every reason to believe that a satellite system could give a real push to education and development.

India, as we have said, is the classical case of the heterogeneity problem, but cultural, educational, and linguistic heterogeneity is the classical problem of television satellites, and other countries must face it too. As a matter of fact, all the considerations raised in this chapter as applicable to India are probably equally applicable to any country trying to decide whether to adopt a television satellite. Satellite or no satellite, a country that thinks of a broad expansion of television must ask:

-- Are the resources available to do the job adequately? In particular, capital investment and operating costs will be large. Consequently, it is necessary to ask what desirable system configurations are likely to be cheaper than others?

-- Is the technical base available, or can it be built up in time? India's problems in this respect are to create an industry to manufacture receivers and other equipment, to provide suitable interconnections for stations, to make electric power available in more villages, and in general to hasten electronic development.

-- Is the personnel base adequate, or can it be built up in time? India would have to train some hundreds of thousands of people, some for a few days, some for several years, in skills as different as those of engineers, technicians, producers, writers, studio and classroom teachers, field staffs, and ministry personnel.

-- What pattern of organization and control will best free television to do a creative job in the broad national interest, and at the same time keep it in close working contact with all the agencies and individuals that must play a part in the national service? In the case of India, one of the chief questions is whether television would function best within a government ministry or as a public corporation.

-- How long a period of preparation, and what kind of preparation, will be required? There must be careful planning and painstaking preparation if the system is to fulfill its promise. Among other things, there must be basic decisions on a strategy of use, notably on priority objectives and audiences. A system strategy must be developed -- how large should the system be, what shape should it take, how fast should it be developed? What, precisely, will the needs be in personnel, money, and materiel? How shall the new system be organized and controlled? After this planning is done, and a detailed schedule and assignments made, then work must start upon reviewing and planning the content, and making the programs; constructing the equipment and buildings; hiring and training the personnel; and acquiring skill with the use of the system before it goes into public service. In the case of India, this period of preparation would take several years. It is hard to see how any country could do it much more quickly.

The satellite introduces certain other considerations. Two of these seem to us not too worrisome for India at this time -- the problem of satellite signals spilling over into neighboring countries, and the unequal distribution of satellite technology in the world that might result in a technologically advanced country controlling some of the technical functioning of the satellite. The third consideration, however, is crucial. It is the problem we have most recently been discussing: whether local needs, cultures, languages, interests, would so fragment the programming of a satellite that there would be no advantage in the broad coverage it makes possible. Our exercise in programming has given us good reason to think that heterogeneity is not unconquerable, given a bit of ingenuity in system design, scheduling, and programming -- even in a country with 17 State educational systems, 86 agricultural areas, 15 official languages, and highly sensitive cultural groups! Clearly, India's linguistic diversity would dilute the impact of a satellite, and make the job of programming more difficult, but a great deal of the instrument's potential could still be realized.

One tentative conclusion as to how a country like India will probably find it necessary to use a satellite, emerges from this chapter.

Despite the great need to get information into the villages, despite the natural impatience of planners who see a nation-wide transmitter available, there seems every reason for India to move gradually, rather than leap, into the satellite age.

Why? Because it would greatly simplify the problem of entrance. It would smooth out the investment over a longer period. It would provide more time for training personnel, building up electronic capability, providing equipment, and learning how to program for a very difficult situation.

It is not in any sense pejorative to say that India is not ready to leap at once into a nation-wide television information system. What developing country _is_? The resources are not there. The experience is not there. It would be better to climb step by step, consolidating a new expansion before moving on to the next, leaving time for trial and error and for changing a policy if that becomes necessary. The ideal strategy for entering would be a measured approach, every step nearer a national system, but no step foreclosing the opportunity to stop at that point without loss.

In the following chapter, therefore, we shall consider some strategies that include a gradual entrance into national satellite television.

V ALTERNATIVE STRATEGIES AND SYSTEMS FOR INDIA

What pattern might we expect a major expansion of television, designed for education and development objectives, to take in India?

From the preceding chapters certain guidelines emerge.

For one thing, the system, whatever its precise form, should provide a national service if possible. This does not mean that it need serve all of India on its first day of operation, or that it need reach every tiny corner of India even within 20 years. But it should be moving toward national coverage. If it serves only a few States or a few languages at first, the other people of India should know that they are in the plan, too; and that as soon as possible, television will be seen in all the States and available to a substantial number of the people of the nation. This is not only because of obvious political reasons -- no government wants to be thought of as playing favorites with such a costly allocation of resources -- but also because without national coverage there can be no national sharing of common experience by television, and no resulting impulse toward national unity.

In the second place, the system should provide for as much local service and local programming as possible. This is the only way that the heterogeneous needs of India for language and developmental information can be met. Thus, inevitably, the system must balance the efficiency of national coverage against the efficiency of local coverage.

The more local production and local transmission, the more closely the system can adapt to the demanding heterogeneity of India. The fewer the local services and specially targeted programs, the better use can be made of the ability of a satellite to cover wide areas with the same signal. Ingenuity in programming, as we have already said, can help to meet both local and regional needs. But how can the system itself be designed to meet as many of these different needs as possible without simply fragmenting national television so that it loses the sense of nationalness and the efficiency of wide sharing?

Third, the system should be designed so as to offer, if possible, major service to the villages. Obviously, it is easier to put television into the cities than into the rural regions. There is more of a technical base there, more money, more pressure to introduce television, more programming talent, more advertising support if that is desired. The normal way to expand television would be to bring it first to the great cities, then to the smaller cities, and let the villages trail along a few decades behind. The first ground stations will undoubtedly be in the cities. But it is in the villages that television can make its most spectacular contribution to development. On this point the development ministries of India are in agreement. Therefore, if possible the system should be so planned that television would come to the villages much sooner than it would in the ordinary pattern of media development. Village television should grow in tandem with, rather than far behind, city television.

Fourth, the system must be designed so that India can move gradually into the anticipated expansion of television. It is most unlikely that the country will be able to make the entire capital investment at once. And even if it could, the other resources are not there to create the system except over a fairly long period. The required thousands of skilled people are not trained, and the facilities for training them in India do not yet exist. The manufacture of television equipment is only beginning in India. It will take years to build the necessary number of stations and connect them with microwave, if microwave is used. The programs and the programmers are not ready. The necessary review and planning of curriculum and content still need to be done. The schools are not yet ready to receive television. And the required field staffs in education, agriculture, family planning, health services, are either not sufficient in size or otherwise unprepared to make good use of television.

Even if the necessary time for all these kinds of preparation could be foreshortened, still it would be to the advantage of India to move step by step into such an unfamiliar and potent technology. If possible, the plan should make it possible for India to pause on one step and consolidate what it had learned before taking the next step, or indeed deciding which next step to take. A pilot satellite project would help determine, for example, whether India wants to go permanently to the use of a space link, and if so whether by direct broadcast or rebroadcast. It should be possible for the nation to shift its course, or even to decide to go no further, at a given step, without substantial loss of investment or effort.

Again, the hope has been expressed by many people in India that the system would be reliable. When they say this, in most cases they are thinking about the vulnerability of a system that depends on a satellite -- for example, whether the entire national information system would go dark if the satellite failed. This is, of course, really an argument against any system designed around a single gate-keeper through which the whole content flows. It can be met by designing alternate channels or alternate sources of programs -- for example, some ground stations in addition to the space link, reserve transmitting equipment or spare channels in the satellite, a spare satellite in orbit, and so forth. But this problem must be considered in designing a national system.

Finally, the system should be as economical as possible. Other things being equal, the less costly of two systems is likely to be chosen. A system that postpones its heaviest expenses until later probably will be preferable, in India's presently strained but rising economy, to one that requires heavy investment at the outset.

These are some of the considerations we have tried to take into account in sketching out possible growth patterns for television in India.

Assumptions about the system

Before preparing any system designs, however, we have had to make some rather important assumptions.

Some of these are about the rate at which India could accomplish such a major expansion of television as we have outlined.

We have assumed, first, that India could, and very possibly should, take a decision as early as calendar 1968 on how and whether to expand television in a major way.

Looking ahead from 1968, we have assumed that it would be realistic to think of making television available to 80 to 85 per cent of the Indian people within 20 years. This is necessarily an arbitrary figure, but we have sought advice from informed Indians, and have taken into account the need to spread out expenditures, to train a very large corps of skilled personnel, to extend power lines and roads and perhaps microwave links, and to manufacture equipment. We bore in mind also that the cost of reaching the last 15 per cent of the people would be out of proportion to the cost of reaching the others.

In making time assumptions we had to consider two other factors, the rate of expansion of power into the villages and the probable availability of receiving sets. Electric power is now available in all communities of India of more than 10,000, and in a high proportion of towns smaller than 10,000, but in only about 10 per cent of the 568,000 villages. We projected the previous rate of installations and the allocations to power in the Fourth Five-Year Plan, and arrived at the following forecast as to the number of villages that might have electric power at the end of the next four five-year periods:

1st 5 years	100,000 villages
2nd	150,000
3rd	225,000
4th	350,000

Obviously, it will save money and difficulty if the growth of television does not outrace the growth of electric power -- this is another reason for the system to grow at a measured rate. Any plan that aims at national coverage is likely to try to have television follow power lines, but by the third five-year period television is likely to outrun the power lines, and it will then be necessary to install village power supplies. The extension of power, therefore, is likely to be one of the restraining influences on the rate of growth of television.

Another possible restraining influence is the availability of receivers. In this case, however, we were able to make an optimistic forecast, based on an estimate given us by J. K. Electronics, of Kanpur, one of the two firms in India licensed to produce television receivers. If our conservative projection of that estimate is correct, receivers can be produced if needed at the following rates:

during the 1st 5 years	300,000
2nd	500,000
3rd	600,000
4th	700,000

This would mean that receivers are not likely to be a bottleneck to a gradual expansion of television intended to reach most of the population in 20 years. It may be, of course, that set production will not live up to its forecast. Or it may be that the private market for receivers will greatly expand (private sales may depend on the amount of entertainment presented on television). But on the whole the receiver outlook is encouraging.

Concerning the availability of some of the other key elements of the system, we have assumed that no space link except perhaps a pilot project satellite would likely be available to India during the five years beginning in 1968. The pilot satellite, if India is successful in its negotiations to obtain one, would be used for perhaps one year, to test some of the hardware, the problems of programming and maintenance, and the procedures of administering satellite television.

Our assumption, then, is that a long-term satellite, if any, would not come into use before the second five-year period beginning in 1973. In the first five years, however, India could begin at once to construct ground-based television stations if it wished to, and we have assumed that it would be possible to construct and staff perhaps six of these in the first five years. This is not far from the outlook of the Fourth Plan, and the AIR plan.

We considered, then, some of the different kinds of television system, with or without satellites, that would begin at a relatively slow pace and try to bring television to 80-85 per cent of the Indian people in 20 years.

Defining what it means to "bring television to 80-85 per cent of the Indian people" also required certain assumptions of importance. We assumed that if one receiver were installed in a village, this would be sufficient to make television available to all people in the village. And indeed this has been the experience in the villages around Delhi, where as many as 300 people, out of a village population of perhaps 700, often watch the village receiver, and specialized groups concentrate on their own kinds of programs. We have assumed, furthermore, that if governmentally provided receivers were allocated to cities at the rate of one for every 2,000 inhabitants (on the basis of 1961 census figures, which are the last hard figures of this kind we have) all the schools interested in television could be served, and an opportunity for community and teleclub use could be provided. This, we believe, would be meeting the governmental responsibility for "making television available". Beyond that, there would be a considerable private market for receivers in the cities.

About 80 per cent of the people of India are in the villages. If a national system covers 80 per cent of the villages, it should be covering at least 64 per cent of the total population. The other 20 per cent live in cities. If the system covers all of the cities and 80 per cent of the villages, it should then be bringing television to about 84 per cent of the population.

How many receivers would that take? There are nearly 568,000 villages. Covering 80 per cent of those would require 454,000 receivers. At 1961 figures, and assuming one receiver for 2,000 persons. it would take 44,000 receivers for the cities. The objective, then, is to place 494,000 operating television receivers in 80 per cent of the villages and in all the towns and cities of India.

The five strategies

We have sketched out five patterns which, in the light of the preceding guidelines and assumptions, seem to provide promising alternatives for major expansion of television in India. As we shall try to make clear, these are not the only strategies available, and it is undoubtedly the case that Indian planners, with the support of detailed engineering studies, could improve on any of them. Further, it might be desirable to combine elements from several of them to make a new plan. But these at least represent the principal ways of approaching the problem of television expansion, and will serve to illustrate the time, cost, and coverage factors involved. We shall briefly describe each of these strategies in the following pages.

Strategy I: Limited use of television plus extension of local radio

Let us begin with a strategy that does not meet the requirement of national coverage, but rather is a deliberate attempt to limit the size of the job. Instead of trying to cover 80 to 85 per cent of the population, it sets out to cover 40 to 45. Instead of using television to cover the rural areas, it introduces television chiefly where it is easiest to do so, in the cities. To contribute to the local needs of India's rural people, it provides for building a number of additional local radio stations. Radio is already well established in India, but still somewhat lacking in local service. Overall, the strategy is designed to cost roughly half as much as national coverage, and thus to provide an alternative in case India does not feel able at present to go into a plan that provides for full nation-wide television.

Here, in tabular form, is Strategy I:

STRATEGY I -- LIMITED TELEVISION, AND EXTENSION OF LOCAL RADIO: FORECAST OF DEVELOPMENT BY FIVE-YEAR PERIODS

	1st 5 years	2nd 5	3rd 5	4th 5	Total
TV stations	4	7	16	10	37
TV translators	0	0	0	50	50
TV receivers					
In the city	6,000	5,000	8,000	16,000	35,000
In the village	10,000	28,000	40,000	86,000	170,000
Replacement TV receivers*					
City	0	0	6,000	5,000	
Village	0	16,000	44,000	84,000	
Total receivers to purchase	22,000	49,000	98,000	191,000	360,000
Receivers outside power area	0	0	0	0	
Local radio stations	15	10	0	0	25
Radio receivers	15,000	10,000			25,000
Replacement radio receivers			15,000	10,000	
Total radio receivers to purchase	15,000	10,000	15,000	10,000	
Microwave (in miles)	800	1680	1483	550	4513
TV Estimate of coverage at end of 5-year periods	6%	12%	20%	43%	

New radio stations would probably serve between 16 and 24 per cent of the villages.

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* Our assumptions on replacement are given later in this chapter. In general, we have assumed that village receivers will have to be replaced after five years, city receivers after 10.

This plan provides in the first five years for the construction of three new television stations -- probably in Bombay, Madras, and Calcutta -- along with the upgrading of facilities at the Delhi station; and the construction of 15 local radio stations in key agricultural areas. The television stations would have one to four studios, depending upon the amount of local production contemplated, and the radio stations also would have production facilities so that they could focus on meeting the particular needs of their coverage areas, in addition to carrying parts of the national radio service. There is no provision for microwave interconnection of the television stations at first; programs would have to be exchanged by videotape, which could be carried to most stations by India's excellent rail and air system, until microwave becomes available. Thus, while the advantage of timeliness would be lost to some programs, still there would be some sense of a network.

In the second five years, seven more television stations would be added -- probably at Kanpur or Lucknow, Hyderabad, Ahmedabad, Patna, Bangalore, Trivandrum, and Bhopal -- and 10 more local radio stations. In the second ten years 26 more television stations would be added, in the other State and territorial capitals and key cities of high density population areas. Fifty translators would also be installed to expand the coverage areas of the stations. At the end of 20 years, therefore, there would be 37 television stations, 25 new radio stations, catering to local needs, about 205,000 publicly provided television receivers, and 25,000 additional village radios. It must be remembered that many villages already have radios. We estimate that about 43 per cent of the

Indian population would have television available to them, by means of this plan, after 20 years, and that 16 per cent or more of the villages would have been getting special local radio programs as a result of the new stations.

We make no special claims for the accuracy of our estimates of coverage. For the principal television stations, we have had city populations and census estimates of density of population in the surrounding State. We assumed that the stations would cover something of the order of 7,500 square miles and have made our estimates accordingly. This is less satisfactory, of course, than working from an engineering survey which provides optimum station location, contours of coverage area, and related population data. When we have not known precisely where the stations would be, we have had to make a rough calculation on the probable locations and average densities, or in some cases merely on the average size of a village multiplied by the number of sets. Thus we have tried to steer a middle path between estimates based on geographical areas and estimates based on number of receivers. Such estimates are obviously no substitute for a careful engineering survey, but they have been made in the same way for all the strategies and should therefore furnish a common basis for comparison. We should expect that the coverage figures are accurate within 10 per cent -- that is, that the true figure represented by an estimate of 30 per cent will lie between 27 and 33.

Strategy II: Ground-based television

If the first strategy is a limited and relatively inexpensive way to expand television, Strategy II is the orthodox way to expand it nationally. This plan makes no use of a satellite, and depends upon no unfamiliar technology. It simply expands ground-based television in gradual steps, connecting the stations with microwave so that they can share a national service. At the end of 20 years, it is designed to serve about 84 per cent of the people of India. Here is a tabular view of the plan:

STRATEGY II -- GROUND-BASED TELEVISION:
FORECAST OF DEVELOPMENT BY FIVE-YEAR PERIODS

	1st 5 years	2nd 5	3rd 5	4th 5	Total
TV stations	6	11	35	48	100
TV translators	0	20	40	40	100
TV receivers					
City	7,500	6,000	8,000	12,500	44,000
Village	24,000	56,000	164,000	210,000	454,000
Replacement TV receivers					
City	0	0	7,500	6,000	
Village	0	24,000	80,000	244,000	
Total receivers to purchase	31,500	86,000	263,500	478,500	859,000
Receivers outside power area	0	0	44,500	148,000	
Microwave (in miles)	2,180	1,910	4,028	5,828	13,946
Estimate of coverage	8%	17%	44%	84%	

In the first five years, then, the Delhi station would be upgraded, and new stations, all with major studio facilities, would be constructed, probably at Bombay, Madras, Calcutta, Hyderabad, and Kanpur or Lucknow. These would be connected with microwave. In the second five years, another 11 stations would bring television to the other State capitals.

Thirty-five additional stations in the third five years, and 48 more in the fourth five years, would bring the total number of stations to 100. Thus there would be a station in most of the cities of India of over 100,000, and translators would be installed to carry their signal as far as possible beyond the usual Class A coverage area. After the first 16 or so primary stations, there would be much less need for studio facilities, inasmuch as the whole network would be connected by microwave, and there would always be at least one station with production facilities for each main language and for each State. We are estimating, without an engineering survey, that 100 VHF stations and 100 translators would bring television to 84 per cent of the population. The assumption seems relatively safe, inasmuch as AIR estimated, in its long-range plans, that 150 stations would cover all of India, and the Unitel design (shown us privately), which tried to locate stations in the most favorable geographical position, assumed that 100 stations without translators would cover the country. Nevertheless, let us again make clear that anyone who thinks of putting this strategy into effect would have to make a detailed engineering study.

As in all the other strategies aimed at covering 80 to 85 per cent of the Indian population, this one provides for placing 44,000 public receivers in cities, and 454,000 in villages. It would require approximately 14,000 miles of microwave connection. In this latter estimate we have followed Indian Posts and Telegraphs and AIR figures.

Strategy III: Direct broadcasting from a satellite

This design is as different as one can be from those we have just described. It would have no ground-based television stations whatsoever. All broadcast signals would come from a satellite and be received on television sets with special dish antennas and other front-end augmentation. Programs would be prepared at special production centers (ultimately a total of 16, representing the chief languages, cultures, and political areas) and transmitted to the satellite from five different locations, attached to production centers.

We envisage this strategy as beginning very slowly. In the first five years there would be little actual broadcasting activity except the pilot project, for which we have specified the number of receivers envisaged for the INCOSPAR-NASA pilot test. A permanent satellite would supposedly be available, however, at or near the beginning of the second five-year period, and at this time it would be possible to expand the number of receivers as rapidly as they could be installed and arrangements made for power and installation.

In the first five years, preparatory activity might well focus on the first three production centers -- Delhi plus two others, perhaps Bombay and Madras -- and on the first two earth stations to send signals to the satellite. These first two would supposedly be Ahmedabad, which already has a considerable amount of equipment and experience, and perhaps Delhi, which is in the Hindi area and would be the source of many national programs. In later periods, the number of production centers would be expanded gradually through the States and the language areas, and three more earth stations would be added. Videotape copies of programs from the production centers would probably be sent to the earth stations by air, rail, or road. This being the case, it would be important to locate most of the earth stations at or near some of the probable chief sources of programs, such as Delhi where the national government is centered, Bombay where there is a large concentration of motion picture talent and a new center for the performing arts, and Madras where there is another concentration of movie talent and where many of the arts of South India could more easily be represented.

Covering only about one fifth of the Indian population at the end of ten years, this design would then grow very rapidly, and cover 84 per cent at the end of 20 years.

Here is a table of Strategy III:

STRATEGY III -- DIRECT BROADCAST FROM SATELLITE: FORECAST OF DEVELOPMENT BY FIVE-YEAR PERIODS

	1st 5 years	2nd 5	3rd 5	4th 5	Total
TV stations	0	0	0	0	0
TV translators	0	0	0	0	0
Augmented receivers					
City	1,000	12,000	15,000	16,000	44,000
Village	4,000	80,000	170,000	200,000	454,000
Replacement receivers					
City	0	0	1,000	12,000	
Village	0	4,000	84,000	254,000	
Total receivers to purchase (all augmented)	5,000	96,000	270,000	482,000	853,000
Receivers out of power area	0	0	35,000	132,000	
Satellite*	(Pilot)	1	1	0	
Earth stations, transmitting to, receiving from satellite	2	2	1	0	5
Production centers	3(+Delhi)	5	4	3	16
Estimate of coverage	2% (during pilot)	19%	55%	84%	

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* We have assumed that the life of the first "permanent" satellite will be in the neighborhood of five years; of the second one, 10 years.

Strategy IV: Rebroadcast from satellite

Direct broadcasting from a satellite to community or home receivers requires expensive equipment to augment the receiver. Another way to handle the satellite signals without having to build up a ground-based microwave network is to install a large number of rebroadcast transmitters at advantageous places for wide coverage. Many of these could be low power, and most or all of them could be without studios. They would all be equipped with the necessary apparatus to receive the satellite signal, amplify it, and rebroadcast it to standard receivers within their coverage areas. This is what we have envisaged in Strategy IV.

In many ways this would be like the preceding design. There would be five earth stations (two in the first five years) and ultimately 16 production centers representing the States and the chief languages. But this plan could get under way more quickly than Strategy III because even in the first five years there would be six ground-based VHF stations, supposedly without studios but equipped with videotape recorders. Thus, even in the first five years the existing production centers could feed programs on videotape to these stations for rebroadcast. The 16 production centers envisaged in this plan would be identical with the 16 ground-based stations. The pilot satellite project could and should take place, as in Strategy III, but it would not be necessary to wait until a permanent satellite was available before instituting a regular schedule of broadcasts.

Here is a table of this strategy:

STRATEGY IV -- REBROADCAST FROM SATELLITE: FORECAST OF DEVELOPMENT BY FIVE-YEAR PERIODS

	1st 5 years	2nd 5	3rd 5	4th 5	Total
TV stations	6	5	5	0	16
TV translators and other low-power rebroadcast stations	18	132	270	420	820
Receivers					
City	10,000	12,000	12,000	10,000	44,000
Village	45,000	101,000	128,000	180,000	454,000
Replacement receivers					
City	0	0	10,000	12,000	
Village	0	45,000	146,000	274,000	
Total receivers to purchase	55,000	158,000	296,000	476,000	985,000
Receivers out of power area	0	0	83,000	148,000	
Equipment for receiving from satellite	22	135	274	400	831
Satellite	(Pilot)	1	1	0	
Earth stations	2	2	1	0	5
Production centers (added to chief transmitting stations)	3(+Delhi)	5	4	3	16
Estimate of coverage	18%	35%	59%	84%	

Thus, strategy four would move receivers out gradually through the country, reaching 18 per cent in the first five years, 35 per cent in the second, until about 84 per cent of the people had television available to them.

Strategy V: Combination of ground-based television and direct broadcasting from a satellite

Strategy V was designed in an attempt to combine the elements of Strategies II and III so as to share their advantages.

It provides for a limited number of ground stations in the cities, and a satellite that would broadcast directly to receivers in the more remote villages and smaller towns. A glance at the following table will show that four ground stations (an upgraded Delhi plus three others) would be constructed during the first five years, while a satellite pilot project will prepare the way for the later expansion of direct satellite broadcasting. During the first five years, only 2,000 augmented receivers will be provided, and these for the pilot project to try out direct broadcasting. But the 22,000 standard sets to be placed in the cities and surrounding areas will make it possible to reach a sizable segment of the population even in that first period. Thereafter, assuming that a permanent satellite comes into use, it will be possible to expand the system rapidly.

A total of 24 ground-based stations is specified. These would be in the State capitals and other important cities. As in Strategy IV, it is anticipated that the first 10 to 17 of these would also be production centers for the satellite. There would be five earth stations to communicate with the satellite. These would be close to five of the chief program sources, including, of course, Delhi, Bombay, and Madras, and probably Calcutta or Hyderabad, so as to make it as easy as possible to get the necessary variety of language and local culture programs to the space link.

Here is a table showing how this strategy would work out:

STRATEGY V -- COMBINED SATELLITE DIRECT BROADCASTING AND GROUND STATION BROADCASTING: FORECAST OF DEVELOPMENT IN FIVE-YEAR PERIODS

	1st 5 years	2nd 5	3rd 5	4th 5	Total
TV stations	4	6	6	8	24
Standard receivers					
City	6,000	8,000	6,000	0	20,000
Village	16,000	40,000	25,000	5,000	86,000
Replacement standard receivers					
City	0	0	6,000	8,000	
Village	0	16,000	56,000	81,000	
Total standard receivers to purchase	22,000	64,000	93,000	94,000	273,000
Augmented receivers					
City	0	8,000	8,000	8,000	24,000
Village	2,000	40,000	160,000	166,000	368,000
Replacement receivers (augmented)					
City	0	0	8,000	8,000	
Village	0	2,000	42,000	202,000	
Total receivers to purchase (augmented)	2,000	50,000	218,000	384,000	654,000
Receivers out of power area	0	0	94,000	148,000	
Equipment for satellite receiving stations	2	4	5	8	19
Earth stations transmitting to, receiving from satellite	2	2	1	0	5
Satellite	(Pilot)	1	1	0	
Estimate of coverage	17%	33%	58%	84%	

We can sum up the chief differences in the strategies this way:

	Strategy I	II	III	IV	V
Medium	TV and radio	TV	TV	TV	TV
Transmitter	Ground-based TV and radio	Ground-based TV	Satellite	Satellite rebroadcast from ground stations	Satellite plus ground stations
Receivers	Standard	Standard	Augmented	Standard	Some augmen some standa
Program source	Stations	Stations	Production centers	Production centers (stations)	Production centers (stations)
Network service through	Tape exchange until microwave available	Microwave	Satellite	Satellite	Satellite
Coverage					
After 5 years	6%	8%	2%	18%	17%
20 years	43%	84%	84%	84%	84%

Assumptions as to cost

As a first step in evaluating these strategies, let us try to make at least a rough estimate of their cost. This requires making certain assumptions about what the costs will be in India.

We are rather uneasy about these estimates and assumptions, for one thing, because we are forced to use current prices and salaries to forecast costs as much as 20 years in the future, whereas we have no reason to think that prices and salary levels will not change during that time. Furthermore, India has not had a broad enough experience with operating television and manufacturing television equipment to establish a firm basis for projecting costs into the future. In her radio, and the one television operation to date, India has a tradition of maintaining rather larger staffs than most countries, and constructing rather elaborate buildings (except for TV in Delhi) with much duplicated equipment. Whether this tradition, or the rather more sparse and economical pattern of most developing countries will carry over into television, we do not know. Nor do we know how much of the necessary equipment it will be necessary to import and, if so, what will be the policy toward import duties, which are now very high and which are often charged even to government ministries and agencies.

Therefore, the best we can hope from the estimates that follow is to establish some order of magnitude figures, and to make it possible to compare the different strategies using the same units of estimated cost. Let us now state what we have assumed these units to be.

Standard receivers: $240, including antenna and tax. There seems to be rather general agreement on this, and it is precisely the figure cited by J. K. Electronics, by Vepa in his INCOSPAR paper, and by the Unesco team. We are not arguing, of course, that this receiver could not be made, in quantity, for less in the United States, Japan, or certain other countries. This is simply an Indian figure based upon Indian prices.

Augmentation for receivers: $150. Estimates of the cost of dish antennas and augmented front-ends for direct reception from the satellite vary from $534 (Unesco team) to $105 (Vepa in his paper for the UN space conference). These differences, of course reflect both the fact that augmented front-ends for direct reception have never been made in quantity, and also the fact that there is considerable uncertainty as to the power of the satellite which is to be used. Thus, the Unesco team is supposedly estimating for a low-power pilot project satellite. The Hughes estimate of $500 is also for a relatively low-power satellite. The ASCEND project estimated $346 for front-ends made in large quantities for a fairly large satellite. We have assumed that the first permanent satellite, if any, for India will be a high-power unit; this is one reason why it would not be available until the second five years of the project. Here we have the choice of two estimates for high-power satellite reception: Vepa's $105 and General Electric's $150. We have chosen to use the higher of the two. If it still turns out to be too low, then Strategies III and V will look less attractive financially.

Power supplies: $100. We have a number of estimates, in rather close agreement, on the cost of a village power supply sufficient to operate a television receiver. These vary from about $70 for an animal-driven unit, a little more for one driven by a bicycle, a little more yet for a wind-driven generator, to about $120 for a generator driven by an internal combustion engine. The last of these would doubtless be the most reliable, but also the most difficult for villagers to operate and repair. We have taken a figure in the middle, assuming that doubtless there will be many generators driven by water buffaloes or bicycle power, even though there are obvious advantages in a motor generator.

Microwave: $6,667 per mile ($3,990 per kilometer). This is a Posts and Telegraphs figure, based on experience, and concurred in by all the people who have stated a cost for microwave links in India.

Television stations: $2 million for a station with two to four studios, $1 for a station without production facilities. The latter figure is from INCOSPAR. All India Radio estimates $1.2 million for the same unit. AIR also estimates $2 as the cost of a one-studio station. However, since it seems possible to obtain land, building, transmitter, and tower for $1 million, it would seem not at all unreasonable to expect to pay no more than an additional million for two to four studios. Actually, it has been done for considerably less in certain developing countries where people were willing to build sparsely. And in American Samoa, where they have quite remarkable technical equipment and thoroughly adequate buildings, it proved possible to install six VHF transmitters, two towers on a mountain reached by an aerial tramway (which itself cost $195,000), seven translator stations, four studios, eight camera chains, and 10 large videotape recorders ($314,000), all for

$2.3 million. Therefore, it seemed to us reasonable to use the figure of $2 million in estimating the cost of a station with two to four studios, and to suppose that some stations will probably need four, others not. If this cost turns out to be too low, then Strategy III (direct broadcasting) will look comparatively better than the others.

Radio stations: $300,000. This agrees with All India Radio's estimate, and with foreign prices adjusted for Indian delivery, for a medium wave station with two towers and a 50 KW transmitter and production facilities.

Radio receiver: $50. This is a transistorized receiver, prepared for rugged use in a village. The Indian custom is to charge half the cost to the village, half to the central organization; therefore we have used $25 in figuring radios into our estimate.

Low-power translator station: $150,000. This checks with RTV International's experience with developing countries, and also with University of Michigan estimates. Obviously the power of the transmitter, and to a certain extent the sensitivity of the receiver, will affect this price.

Equipment for station reception from satellite: $100,000. This estimate is by Vepa, of INCOSPAR, for the Indian situation. We should expect this cost to go down as the power of the satellite goes up.

Satellite: $20 to $30 million. This depends on the power and capacity of the satellite, the size of the necessary launch vehicle, and the proportion of development cost, if any, charged to it. We have assumed that the pilot project satellite, if any, will be made available to India free of charge; that the permanent satellite to be available after five years or so will cost in the neighborhood of $20 million, and the more powerful model available after 10 years will cost in the neighborhood of $30 million. These are toward the high end of the estimates given India by the industrial organizations and engineers that have interested themselves in the problem.

Earth station: $1 million. On the basis of INCOSPAR estimates and U.S. engineering advice, we have assumed that for an earth station able to transmit to the satellite and receive from it, the cost would be of this order. The figure includes building and land. To add equipment for this purpose to an existing station would cost in the neighborhood of $700,000.

Maintenance. INCOSPAR estimates the annual maintenance cost of studio and transmitter equipment at 10 per cent, of capital cost, of the building at 2 per cent. They also suggest 10 per cent as a probable annual cost for maintenance of television receivers, and we have adopted this figure with a warning flag. Actually, 10 per cent of the original cost per year is not far from the mean of reported maintenance costs of television receivers in American Samoa, Colombia, and Nigeria, but none of these countries has done precisely what is proposed to do for India -- to place receivers, many of them outdoors or on a porch, in hundreds of thousands of villages, many of them remote from any electronic development. India's total experience with maintaining television receivers in villages derives from the 79 settlements near Delhi, which are hardly typical, which have had television less than two years, and which report a considerable amount of trouble with receivers out of order. It may well be, therefore, that our figure of 10 per cent of capital cost per year may be too low. The cost and requirements of maintenance are, therefore, questions to try to answer in the first few years of experience with village television. For radio station maintenance we have used the same figure as for television, and for maintaining a microwave system we have used 5 per cent, on Indian advice.

Replacements. We have assumed, on engineering advice from India and the United States, that village receivers, on the average, would have to be replaced after five years; city receivers, after 10; and studio and transmitter equipment after 20. We assumed, further, that the pilot project satellite, such as is envisaged for the INCOSPAR-NASA pilot, would be available for one year during the first five years of the project; that the first "permanent" satellite would have a probable life of five years, and the second "permanent" satellite, which would be needed in the late 1970's, would have a probable life of 10 years.

Cost of operation. Our assumptions about operating costs are based upon the experience of the Delhi television station, cross checked against budgets for similar operations in American Samoa and Colombia, and for ETV stations in the United States. By all normal standards, the Indian costs seem inordinately high, but this is consistent with experience in other areas. Even officials of the Delhi station, for example, state that the operation is overstaffed by 50 per cent or more for the 20 hours a week which constitutes the current program schedule.

All things considered, however, the Delhi experience offers the best single yardstick for projecting costs of operation for an all-India system. Accordingly, such adjustments as we have made have been in the direction of increasing the number of hours of output for approximately the same size staff at the five major production centers: Delhi, Bombay, Madras, Calcutta, and Hyderabad. Since the proposed schedule for both pilot and regular satellites calls for a considerable increase in hours of programming, the saving in manpower costs is substantial. If we are too optimistic, however, then total costs for each strategy might rise by 5 or 10 per cent.

To meet program requirements for the kind of national service which has been discussed in this report, at least five major production centers (just named) probably would be needed. These would be supplemented by a minimum of seven supplementary program centers with at least two studios each and by such additional limited production facilities (one studio) as might be needed. Supplementary production centers most likely would be located at Bangalore, Trivandrum, Ahmedabad, Patna, Bhopal, Jaipur, and Kanpur-Lucknow with limited facilities at Chandigrah, Shillong-Guahati, Srinagar, and Cuttack-Bhubaneswar along with other cities which might be added at a later date. This is probably the minimum number of centers that would be required. It takes into account the major language needs as well as the political centers of the various states. It is significant that film production, with fewer centers, follows somewhat the same pattern.

Naturally, staffs and operating budgets will vary with the amount or production assigned to each of the centers. In general, however, it is anticipated that the annual operating budget for the major stations will be in the range from $450,000 to $500,000, with supplementary production centers running from $250,000 to $350,000 and limited local production stations averaging from $175,000 to $225,000. Requirements for engineering-technical personnel would be proportionately higher in the smaller stations because of the lack of local production.

In all cases, operating costs include not only salaries, but also supplies and services, power, furniture, minor equipment, motor cars, maintenance of plant and equipment, replacement parts and supplies, film rentals, honoraria for non-staff members, travel, royalty payments for films, publicity, and scheduling.

How much will it cost?

We are now in position to make rough estimations of the cost of the several strategies.

First, the cost of capital investment: What would be the bill for equipment and construction if we could put the system to work at once, without figuring in replacements, maintenance, or operations? This is our estimate:

THE FIVE STRATEGIES: CAPITAL INVESTMENT OVER 20 YEARS, OMITTING REPLACEMENTS FOR SATELLITE AND RECEIVERS

(Costs in $ millions)

	1st 5 years	2nd 5	3rd 5	4th 5	Total
I. Limited TV and extension of local radio					
5 year cost	22.5	29.9	37.9	46.6	136.9
II. Ground-based TV					
5 year cost	35.2	43.4	114.5	162.5	355.6
III. Direct broadcast from satellite					
5 year cost	11.0	35.9	114.7	101.4	263.0
IV. Rebroadcast of satellite signal					
5 year cost	37.4	74.1	85.8	112.4	309.7
V. Combination of ground stations with their own production facilities, and direct broadcast from satellite					
5 year cost	15.3	62.2	120.9	96.6	295.0*

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* Vepa's estimates, in his paper for the UN space conference, are $393 million for ground-based TV with microwave; $225 million for direct broadcasting from a satellite; $325 million for conventional rebroadcast stations with satellite interconnection; and $224 million for a combination of rebroadcast and direct broadcast from satellite.

Of the large-scale expansions, direct broadcasting from the satellite seems to cost the least, and ground-based television the most. This agrees with Vepa's conclusion, cited in the footnote. The two options that include rebroadcasting from ground stations are between the two we have mentioned, and the limited plan is indeed a bargain-basement opportunity -- about half as costly as the lowest of the national strategies -- but for only about half the population coverage.

But this is not a wholly realistic way to figure capital cost. If we spread out the investment over 20 years, during that time many receivers will have to be replaced, and the options that depend upon satellites will have to supply at least two each of these, and probably a pilot project satellite as well. Therefore, it seems to provide a better picture of capital costs to include all the cost of replacing capital equipment during the 20 years. The following table represents those figures.

THE FIVE STRATEGIES: CAPITAL INVESTMENT, AVERAGE ANNUAL COST, AND POPULATION COVERAGE OVER 20 YEARS

(Costs in $ millions)

	1st 5 years	2nd 5	3rd 5	4th 5	Total
I. Limited TV and extension of local radio					
5 year cost	22.5	33.8	48.9	64.1	169.3
Average year	4.5	6.8	9.8	12.8	
TV coverage	6%	12%	20%	43%	
II. Ground-based TV					
5 year cost	35.2	49.2	135.5	222.5	442.4
Average year	7.0	9.8	27.1	44.5	
TV coverage	8%	17%	44%	84%	
III. Direct Broadcast from satellite					
5 year cost	11.0	69.4	147.8	205.2	433.4
Average year	2.2	13.9	29.6	41.0	
TV coverage	2%	19%	55%	84%	
IV. Rebroadcast of satellite signal					
5 year cost	37.4	84.9	153.2	181.0	456.5
Average year	7.7	17.0	30.6	36.2	
TV coverage	18%	35%	59%	84%	
V. Combination of ground stations with their own production facilities, and direct broadcast from satellite					
5 year cost	15.3	66.3	155.0	199.9	436.5
Average year	3.1	13.3	31.0	40.0	
TV coverage	17%	33%	58%	84%	

When replacements are figured in, there is very little to choose, so far as cost goes, between the four national strategies. All of them are at the general level of $440 millions, except for the limited strategy which seems even more of a bargain than in the table preceding, but which, again, covers only half the population.

When we look at these costs in more detail, as in the following table, we see that the great capital item, regardless of the strategy, is for television receivers. For the two plans that include direct broadcasting from the satellite to local receivers, the cost of receivers is three fourths of all the capital budget; for the other plans, about one half. The cost of stations and microwave are large items in the ground-based television strategies. In the three strategies that employ a space link, the cost of satellites is only about 11 per cent of capital investment. Therefore, it is evident that whatever could be done to reduce the cost of receivers or make them last longer, or any investment in the space link that would reduce the cost of augmenting the ground receivers, would make a substantial difference in the total.

THE FIVE STRATEGIES: CAPITAL INVESTMENT OVER 20 YEARS -- PROPORTIONAL DISTRIBUTION BY TYPE OF INVESTMENT

	Strategies				
	I	II	III	IV	V
TV stations, translators, production centers	27.5	27.6	6.7	12.9	8.5
Radio stations	4.4	0	0	0	0
TV receivers	49.5	46.6	76.5	51.8	72.7
Radio receivers	0.8	0	0	0	0
Satellites	0	0	11.5	11.0	11.5
Earth stations	0	0	1.2	1.1	1.4
Special reception equipment for satellite rebroadcast	0	0	0	18.2	0
Microwave	17.8	21.4	0	0	0
Village power supplies	0	4.4	3.9	5.1	5.5

Let us now look at the operating costs. Here are two tables. The first one sums up the average operating cost per year. The second adds in the total capital cost. This includes all replacements, so that the totals in this second table should approximate the total cost of expanding television in India over 20 years.

THE FIVE STRATEGIES: OPERATING COSTS FOR FIVE-YEAR PERIODS, AND AVERAGE ANNUAL COST FOR EACH PERIOD
(in $ millions)

	1st 5 years	2nd 5	3rd 5	4th 5	Total
I. Limited TV and extension of local radio					
5 year cost	8.6	28.6	46.9	66.3	155.2
Average year	1.7	5.7	9.4	13.3	7.8
II. Ground-based TV					
5 year cost	20.8	34.4	84.2	174.1	313.4
Average year	4.2	6.9	16.8	34.8	15.7
III. Direct broadcast from satellite					
5 year cost	4.8	22.5	60.8	114.7	202.7
Average year	1.0	4.5	12.2	22.9	10.1
IV. Rebroadcast of satellite signal					
5 year cost	15.2	45.7	84.5	120.9	266.3
Average year	3.0	4.1	16.9	24.2	13.3
V. Combination of ground-based TV with direct broadcasts from satellite					
5 year cost	7.6	30.2	74.9	128.2	240.9
Average year	1.5	6.0	15.0	25.6	12.0

These tables say that the cost of operation for the national strategies may be expected to rise gradually from a few million at first to something of the order of $22 to $35 million per year after 15 years. The total 20-year cost of bringing television to India, including replacements and annual operations, will be of the order of $700 million. Direct broadcasting from the satellite looks to be the least expensive strategy. The combination of direct broadcasting with ground stations (Strategy V) is in second place. Ground-based television (Strategy II) looks to be most expensive.

The following table sums up the average annual costs, capital and operations, over 20 years. Apparently it would cost an average of a little over $30 million a year to bring television to 84 per cent of the Indian people, but the annual cost would be only $10 million or so in the first five years, and then rise to $60 million or more after 15 years.

We shall not reproduce the table for average annual cost, omitting replacements, but it is perhaps worth noting that these tend to be in the neighborhood of $25 million a year, over 20 years. It has several times been said that national television in India would cost around $25 million a year over a long period, and this is apparently true if one does not count in replacement of receivers and satellites.

THE FIVE STRATEGIES: TOTAL CAPITAL AND OPERATING COSTS OVER 20 YEARS (INCLUDING REPLACEMENTS), AND AVERAGE COST PER YEAR

(in $ millions)

	Capital total	Costs annual average	Operating total	Annual average	Both total	Annual average
I. Limited TV and extension of local radio	169.3	8.5	155.2	7.5	324.5	16.0
II. Ground-based TV	442.4	22.1	313.4	15.7	755.8	37.8
III. Direct broadcast from satellite	433.4	21.7	202.7	10.1	636.1	31.8
IV. Rebroadcast of satellite signal	456.5	22.8	266.3	13.3	722.8	36.1
V. Combination of ground-based TV and direct broadcast from satellite	436.5	21.8	240.9	12.0	677.4	33.8

THE FIVE STRATEGIES: AVERAGE ANNUAL COSTS, CAPITAL AND OPERATING, OVER 20 YEARS, BY FIVE-YEAR PERIODS

(in $ millions)

	1st 5 years	2nd 5	3rd 5	4th 5	Overall average
I. Limited TV and extension of local radio	6.2	12.5	19.2	26.1	16.0
II. Ground-based TV	11.2	16.7	43.9	79.3	37.8
III. Direct broadcasting from satellite	7.0	18.4	41.8	63.0	31.8
IV. Rebroadcast of satellite signal	10.7	26.1	53.1	60.4	36.1
V. Combination of ground-based and direction satellite broadcasts	4.6	19.3	46.0	65.6	33.8

Where do the operating costs go? As the following table shows, the large items are station and production center operation (including programming, transmission, maintenance) and the maintenance of receivers. The dominance of receivers in the economy of national television could hardly be illustrated better than by the table we are about to reproduce. The cost of keeping receivers in operation is nearly equal to the entire cost of producing and transmitting the programs in two of the national strategies; it is actually greater than the cost of production and transmission in the two strategies that rely on direct broadcast from satellites. It is evident that the cost of maintaining microwave links can also be considerable, when that method of interconnection is used.

THE FIVE STRATEGIES: DISTRIBUTION OF OPERATING COSTS AMONG CATEGORIES OVER 20 YEARS (in percentages)

	Strategies I	II	III	IV	V
TV stations, production centers, translators	63.6	45.5	35.7	42.1	41.0
Radio stations	5.9	0	0	0	0
Microwave	10.3	13.0			
TV receivers	18.9	39.6	56.8	36.1	49.7
Radio receivers	1.2	0	0	0	0
Earth stations	0	0	5.0	4.2	4.7
Special equipment for receiving satellite	0	0	0	3.8	0.1
Village power supplies	0	1.8	2.5	3.7	4.5

Some unit costs

We now present, with caveats, a few estimates of unit costs.

The caveats are necessary because these are not the kinds of unit costs usually cited for instructional television (e.g., cost per hour per student of televised instruction in the classroom) or for commercial television (e.g., cost per minute per thousand viewers). We do not feel justified in estimating actual future audiences, but have tried to figure probable costs of making public television sets available to given numbers of people.

What does this mean in practice? A television set is placed in a village. Two or three hundred persons (if the experience in the villages near Delhi is borne out) view an hour or two of television every evening. During the week, perhaps three out of four persons in the village view some television. When appropriate school programs are available, we can assume that they will be used by the village schools. Thus, the public receiver is available for general viewing, and for the special uses around which programs will undoubtedly be designed -- school instruction, literacy classes, agriculture forums, teacher in-service training, and so forth. However, at any given season the attendance may be low or zero (for instance, if the receiver is out of order). The costs we are going to cite do not, therefore, necessarily imply a certain number of hours of viewing by a certain number of viewers.

To estimate the number of persons to whom television is to be available at given times during the next 20 years, it is necessary to project the Indian population into the future. At present, India is growing at the rate of about 2.5 per cent a year. A goal of the family planning program is to reduce this growth to 1.5 per cent. Here is what these two different lines of projection would look like:

PROJECTION OF INDIA'S POPULATION
(in millions)

	At growth rate of 2.5% annually	At rate of 1.5% annually
1968 = 510		
1973	577	549
1978	653	592
1983	739	638
1988	836	687

Now suppose that we set these anticipated population figures against the percentage of the population which the different strategies are expected to reach by a given five-year period, and then divide them into the average annual cost of capital expense and operations during that period. This table is the result:

ESTIMATED COST OF TELEVISION COVERAGE OF INDIA, IN CENTS PER PERSON PER YEAR -- FIVE YEAR AVERAGES FOR DIFFERENT STRATEGIES OF EXPANSION

(a = growth projected at 2.5% annually,
b = growth projected at 1.5%)

Strategy		1st 5 years	2nd 5	3rd 5	4th 5
I.	a	17.7	16.0	13.0	7.3
	b	18.8	17.6	15.0	8.8
II.	a	24.3	15.0	12.5	11.3
	b	25.5	16.5	15.6	13.7
III.	a	26.7	14.8	9.7	9.1
	b	29.1	16.4	11.2	11.1
IV.	a	10.3	11.4	10.9	8.8
	b	10.8	12.6	12.6	11.4
V.	a	13.1	9.0	10.7	9.3
	b	13.9	9.9	12.4	11.4

These are rather extraordinary figures. They say that for an annual expenditure of not much more than ten cents per person, on the average, television can be expanded to 84 per cent of the Indian population. The annual cost per person for the first five years varies, with the strategy employed, from 10 to 27 cents, but comes down as the numbers increase. In the last five years, any of the satellite strategies costs less than 10 cents per person, and the cost of ground-based television is only a little over 11 cents.

Once again, a caveat: We are not trying to say that ten cents will buy an hour's television viewing each evening of the year from 84 per cent of the population of India. But suppose it will buy, on the average, only one hour's viewing per person per week. (This is a conservative estimate in view of the experience in the area around Delhi.) Then the cost in the last five-year period would be 70 cents per person per year. If a person viewed an hour a week, on the average, throughout the year, the cost would be a little over 1 cent per hour per person.

Another way to look at these unit costs is to divide the total population which we hope to reach by television (84 per cent of the Indian population in 1988) into the total cost -- production, operation, maintenance, and capital investment -- over the 20 years. This is done in the following table. Whereas the cost varies by strategy and by the rate of population growth which is projected, still it is evident the total bill for making television available to 84 per cent of the population is not much over one dollar per person. If we assume, as before, that only one out of seven persons makes use of television in a given week, then the cost per person over 20 years is less than 10 dollars. Here is the table of total costs:

COST OF BRINGING TELEVISION TO 84 PER CENT OF THE INDIAN POPULATION, BY DIFFERENT STRATEGIES -- IN CENTS PER PERSON, FIGURED AT LEVEL OF POPULATION PROJECTED FOR 1988 WHEN STRATEGIES ARE PLANNED TO REACH 84 PER CENT

	Original capital cost omitting replacements		Total capital and operating cost over 20 years	
	If population grows at		If population grows at	
Strategy	2.5%	1.5%	2.5%	1.5%
II. Ground-based TV	50.7	61.6	107.7	131.0
III. Direct broadcasting	37.5	45.6	90.6	110.2
IV. Rebroadcast of satellite signal	44.1	53.7	103.0	125.3
V. Combination of ground-based TV and direct broadcast from satellite	42.0	51.1	96.5	117.4

Some forecasts of personnel needs

Money, of course, is not the only resource that must be allocated to expanding television in India. One of the key resources is skilled personnel. We have tried to get some idea what the order of magnitude of personnel needs will be.

Using the present Delhi staffing pattern as a basis, we have estimated the requirements for production, technical, and office and management personnel for two very different strategies -- ground-based television and satellite direct broadcasting. In each case we have assumed that there would be five major production centers and seven supplementary production centers. In the ground-based system, these would be stations; the other stations would have no local production. In the satellite strategy, they would be production centers feeding programs to the space link. We have an uneasy feeling that, Indian staffing practices being as they are, we may have underestimated the number of personnel that would actually be used in contrast to the number which would be required.

In trying to get some sense of the field staffs that would be needed, we may have erred in the opposite direction, by setting up an ideal staffing pattern that may prove to be unrealistic. We have assumed that ideally there should be one village level worker for each six villages with television, so that he could spend the equivalent of one day a week in each village. There are now about 40,000 village level workers; a total of nearly 75,000 ultimately would be required to meet the standard of one worker to six villages with television.

This would mean that one additional worker would have to be added, on the average, for every 13 new television receivers placed in villages.

In estimating the need for educational field workers, to help classroom teachers use television efficiently, and to feed back information to the people who make the school programs, we have assumed that there should be at least one of these field men or women for every 25 schools using television, so that the worker could spend the equivalent of one day a month in each school. However, the need for field assistance would decrease after one year of television experience, and therefore we have assumed that in the second year only half as many education field workers would be needed in any given television area. We have assumed, furthermore, that 80 per cent of television sets would be used, in part, by schools, and have figured the need for field staff on that basis.

Here are our estimates:

FORECAST NEEDS FOR CERTAIN TYPES OF SPECIALIZED PERSONNEL IN EXPANSION OF TELEVISION OVER 20 YEARS

(The figures are for additional personnel to be added during each five-year period, and do not take account of the need for replacing personnel)

	1st 5 years	2nd 5	3rd 5	4th 5	Total
Strategy II, Ground-based TV					
Broadcasting --					
Production	492	528	334	265	1619
Technical	724	708	1115	1135	3682
Office, management	282	146	195	220	843
Field --					
Village level workers	1846	4307	12,615	16,154	34,922
Education	1000	1452	4528	4368	11,348
Strategy III, Direct broadcast from satellite					
Broadcasting --					
Production	244	210	190	90	734
Technical	384	520	450	270	1624
Office, management	160	168	152	72	552
Field --					
Village level workers	307	6154	13,077	15,385	34,923
Education	160	2784	4448	3952	11,344

We have not ventured to estimate the needs for receiver maintenance personnel, because we do not see very clearly how this system is going to operate. Nevertheless, it is clear that several thousand maintenance workers will be needed. The INCOSPAR members of the NASA-INCOSPAR planning group estimated that 33 persons at different levels (including two engineers and four senior engineering assistants) would be needed to maintain about 4,200 receivers. This seems like a very low estimate in view of the difficulty in reaching many of the villages where receivers will be placed. However, if this ratio were projected to 498,000 receivers, it would represent a need for about 1,600 persons, including several hundred engineers. Some Indian broadcasters have suggested that, for remote villages, there might have to be an average of one maintenance man for each 10 villages. This would require up to 50,000 maintenance personnel, a figure that seems as high as 1,600 seems low. The best estimate we can now make is that at least several thousands of persons, of varying degrees of skill, will be required for maintenance service. How to organize and distribute them most efficiently is something to be studied during the pilot project.

Which strategy?

Without venturing to tell India what it should do or trying to predict what it will do, we can now take stock of some of the advantages and disadvantages of these five strategies.

There is a basic choice between a limited expansion of television to cover about 40 per cent of the population, and a major expansion to cover 80 per cent. The first option is represented by Strategy I, the second by Strategies II, III, IV, and V.

The limited expansion is the easier way to go. It costs half as much as the others. It puts television primarily into the cities, where the medium can most easily be installed and maintained, and where there is presently the greatest pressure for it. It makes a bow to the special needs of the villages by building 25 local radio stations that will be especially concerned with local programming. On the whole, it is a very attractive strategy, and the only real objection to it is not related to what it does, but what it does not do.

If the Indian village is really the principal battleground of national development, is it a wise policy not to make major use in the villages of the most powerful informational weapon India has available? Although the pressure for expanding television now comes from the cities, rather than the villages, what would villagers think of this policy ten years from now, when all the very large cities and some of the others have television? Moreover the political power of the villages is rapidly rising, as Indian leaders now point out. Would the villagers feel they have been treated like second-class citizens? And if television is really able to contribute to national integration, is it wise not to aim toward a truly national television service? These are questions which India or any developing country would have to answer when deciding deliberately to limit its use of television, as does Strategy I.

Each of the other strategies, II through V, has certain advantages and disadvantages when measured against the others.

Recall the guidelines stated early in this chapter:

1. A national service if possible.

All the four larger strategies approximate this by bringing television to 84 per cent of the population.

2. As much local service and local programming as possible.

Here the weakest of the strategies is likely to be III (direct broadcasting from the satellite). As we demonstrated in Chapter IV, it is by no means impossible for satellite programming to handle a number of different languages and needs, but the task does dilute the service which the satellite can bring to any one language or culture group, and is a great deal more difficult, say, than trying to meet local needs through a number of local ground stations. It is our judgment, therefore, that Strategy II (ground-based television) is likely to find it easiest to meet local needs, and Strategy V (the combination of ground-based and satellite transmission) is likely to come closer to special local service than are III and IV.

3. Major service to the villages.

All the larger strategies will cover about 80 per cent of the villages, but it will be easier to move television quickly into the villages by means of direct satellite broadcasting than by any of the strategies that must wait on the construction of ground transmitters. Direct broadcasting (III) is therefore best adapted to this task, and the combination of ground-based and satellite broadcasting (Strategy V) is likely to be the second most effective strategy.

4. Move gradually into national television.

All the strategies are designed to expand by gradual increments toward their goals of 84 per cent coverage, but Strategies IV and V get off to a faster start with less abrupt jumps.

5. Move step by step into television.

All the strategies are quite flexible in this respect. India could decide at the end of the first five years not to go on, or to go on with a different means of delivering television, or to change the rate of development. As these designs have been made, however, a decision to go no farther or radically change directions at the end of the first five years of Strategy III would not leave much except 5,000 darkened picture tubes. Strategy II would have six operating ground stations even if it were decided not to build any more, or to change to satellite transmission. Strategy V would have four operating ground stations even if it were decided not to develop the space link, and Strategy IV would have six production centers with transmitters, which could begin operating at once as ground stations. In this respect, any of the others would seem to have an advantage over Strategy III.

6. As invulnerable as possible to a failure in one link of the system.

If the microwave failed, all the ground stations with production facilities in Strategy II could still function as independent units until the connection were repaired. If the satellite failed in Strategy V, the ground stations could continue to program and operate, perhaps exchanging programs on tape. Similarly, the production centers in Strategy IV could put out their own programs through their own transmitters. The system that would seem to be most vulnerable is Strategy III. If the satellite channel failed, without spare equipment, a spare channel, or another satellite in orbit, then the entire system would be out of use until a new space link were provided.

7. As economical as possible.

Direct satellite broadcasting (Strategy III) seems to be the least expensive of the large systems, and ground-based television (Strategy II) the most expensive. The combined strategy (V) is second only to III in economy. It should be pointed out, however, that we are not dealing with spectacular cost differences, once we decide upon a national service. Although the limited service is notably cheaper than the others, the most economical of the national services is only 15 per cent less expensive -- 6 million dollars a year on the average -- than the most expensive national strategy. The cheapest of the national services (III) averages $31.8 million, the next cheapest (V) averages 33.6, the third (IV) 36.1, and the most costly (II) only 37.8 a year. These are not great enough differences, in light of a total expenditure of around $700 million, to dissuade a country from choosing an alternative that comes nearest to meeting its needs if that one happens not to be the least expensive.

Which strategy? Which one comes closest to India's priority goals?

If it is economy, then the limited service (I) recommends itself, and among the national services the nod goes to III.

If it seems most important to get television as quickly and widely as possible to the villages, then direct broadcasting (III) must be the first choice.

If it is most important to provide the greatest possible amount of flexibility for local programming, and to work with familiar technology even at higher cost, then ground-based television (II) is the answer, and direct satellite broadcasting (III) is the least desirable.

Strategies II and III, ground-based and direct satellite broadcasting, are in many ways antithetical. Where one is strongest, the other is weakest. One is the most, the other the least expensive. One is the best, the other the worst, for meeting local needs. One is the best adapted, the other the least well adapted, for bringing television quickly to the village. One has the advantage and disadvantage of old and tried technology, the other the advantage and disadvantage of new and relatively untried technology.

In this circumstance, one looks toward Strategy V which is a compromise between II and III, and combines many of the strengths of ground-based and satellite broadcasting. Strategy V is most economical, next to Strategy III; most adaptable to local needs, next to Strategy II; quickest at bringing television to the villages, next to Strategy III; less vulnerable to a failure in the space link than III, although not so completely unaffected as II; and so forth. It commends itself to the attention of any country that is torn between choices of a completely ground-based, or a completely satellite-delivered, system.

It may well be that combined strategies will prove specially attractive to countries like India. Take one more example of how India might move into large-scale television, using a combined strategy to maintain a maximum amount of flexibility until it has decided exactly what path to take.

Suppose it were to combine the elements of Strategies I and V for the first five years. This would mean it would upgrade the Delhi station and construct three others, probably at Bombay, Madras, and Calcutta. It would put 15 local radio stations into key agricultural areas. And it would conduct a satellite pilot project, like the NASA-INCOSPAR plan.

This would be responsive to some of the chief urban pressures for television, and, in so doing, would train a number of personnel and gain valuable experience in producing television for different areas. It would be responsive to the need of the villages, for locally designed agriculture, health, and family planning information. It would also try out satellite broadcasting, and provide a chance to evaluate its hardware and programming problems.

This would cost somewhere in the neighborhood of $33 or $34 million for five years, between $6 and $7 million a year, on the average. At the end of the five years, India would be able to decide on the basis of experience and the outlook at that time, where it wanted to go with television. Whether it opted for a limited ground-based strategy, like I, or a national ground-based strategy, like III, or a combined national strategy, like V, or even if it decided not to develop television any farther at that time -- regardless of which decision it made, nothing would really be wasted, and both the television and the radio services that operated during the first five years could continue to operate usefully.

Summary

This long chapter began with a set of guidelines derived from our previous discussion.

We said that any television system designed for India should if possible:

- -- provide a national service (to help with national integration);
- -- provide for as much local programming as possible (to meet the heterogeneous language, culture, and education needs);
- -- offer major television service to the villages (in support of agriculture, health, family planning, and community development programs);
- -- make it possible for India to move gradually into television (to avoid a crisis of lack of resources at the start of the program);
- -- provide for moving forward step by step (so that policies and plans can be changed without great loss, as India tries to find the right path for itself);
- -- be as invulnerable as technology permits to possible failure of one link in the system (especially the space link);

-- be as economical as a large system permits.

In the light of those guidelines, we sketched out five possible strategies. With the exception of one limited strategy, intended as an alternative in case nation-wide television proves infeasible, these were designed so as to make television available to all the city population and about 8 out of 10 of the villages, in 20 years -- reaching about 84 per cent of the total population. They were planned so as to begin slowly, allowing time for training, construction, and the development of a receiver manufacturing industry, and then to accelerate gradually through two decades, so that the larger expenses and the larger demands on technical resources and skilled personnel would come in the second decade, rather than the first. These strategies were:

I. Limited television (for the cities and surrounding country), and 25 additional radio stations (to provide local radio programming for villages).

II. Ground-based television -- 100 stations, most of them with no production facilities, connected by microwave; and 100 translator stations to extend their coverage.

III. Direct broadcasting by satellite to augmented receivers. This strategy would require no local ground stations, and would deliver the signal directly to village or school receivers, specially augmented for the purpose.

IV. Rebroadcasting by ground stations (16 high-power stations that would also serve as production centers for the satellite, and 820 low-power rebroadcast stations served directly by the satellite).

V. A combination of ground stations with direct satellite broadcasting to village receivers (24 VHF stations in the State capitals and other large cities, and some hundreds of thousands of specially augmented receivers, mostly in the villages, served directly by the satellite).

For each of these strategies we sketched out the number and kind of stations, the amount of microwave linkage, the receivers that would have to be newly installed or replaced in any given period, and the coverage estimated for each stage of development. From these plans it was possible to make rough cost estimates of each system strategy.

Strategy I was, of course, the least expensive, as it was designed to be. It covered about half as much of the population as the larger systems, and cost about half as much. Turning to the national strategies (II through V) we found that a national television service (or the approximation to it which these strategies were designed to achieve) would cost India -- all costs considered -- between $636 million and $755 million, over 20 years, according to which strategy it chooses. This figure includes not only 20 years of operating costs, but also the replacement satellites, if any, and the many hundreds of thousands of replacement receivers which would have to be bought during the two decades. If the cost is stated as it more often is -- original capital cost, omitting replacements -- then the bill ranges from $263 to $355 millions. Adding operating (but not replacement) costs, to the several strategies a nation-wide system could be built for an average of about $25 million a year over the 20 years.

These last figures, let us repeat, did not include replacements. We chose to work with the total cost -- all capital, all replacements, all operating expenses, over 20 years -- because that seemed a fairer projection of what would be required of India. What would this total cost actually mean to India? It would be paying an average of $32 to $38 million a year for 20 years (according to which strategy it chooses) in order to build a system that would make television available to 84 per cent of its people. Of course, the outlay would not be the same each year. In the first five years, it would be less than $10 million a year, and rise to $60 or over after 15 years. Large as these expenditures may seem, they are spectacularly small when measured against the number of people who would be enabled to use television. We tried to express suitable caveats about the meaning of these unit costs, but nevertheless the fact remains that when the system builds to the point of serving 80 per cent of the population, and when annual outlays are at their highest point, television will be costing in toto only about 10 cents per person per year. The total cost of capital and operations over 20 years will amount to only a little over one dollar per person when measured against the numbers who will have television available to them in 20 years.

The least expensive of the national strategies is III (direct broadcasting from the satellite). This costs somewhere near $636 million over 20 years, an average of $31.8 million a year. The combination strategy using ground-based stations along with direct satellite television is not much more expensive -- an average of $33.8 million a year. The most expensive approach seems to be ground-based television -- $756 million total, $37.8 million an average year.

In the strategies employing satellites, these never represented more than 11.5 per cent of capital cost. Receivers are clearly the dominant item of expense. In the strategies employing direct satellite broadcasting, receivers were three fourths of the entire capital investment.

So far as cost is concerned, then, India has the possibility of a very attractive, relatively low-cost service which makes no attempt to serve all of India with television, and does not meet some of the most important guidelines, such as providing a national service and bringing television to the villages, but would be much easier to install, and would cost half as much as a national service. As alternatives to this, it can choose among four national strategies or some combination or variant of them, each of which has some special advantages and disadvantages.

In particular, Strategy II, which depends entirely on ground-based television, and Strategy III, which depends entirely on direct broadcast from a satellite to local receivers, are antithetical. Where one is weak, the other is strong. Satellite broadcasting is least expensive, and ground-based television most expensive. Ground-based television provides the most flexibility for meeting India's heterogeneous needs, but would be slowest of all these strategies at bringing television to the village. Satellite television, on the other hand, has most difficulty with the problem of heterogeneity, but can bring television most quickly and widely to the villages. And so forth.

In this situation, we have been intrigued by the possibilities of Strategy V, which combines ground-based television with direct satellite broadcast, and has many of the strengths of each one. Next to Strategy III, it is the least expensive of the systems; next to Strategy II, it is the best equipped to cope with heterogeneity; next to III, it would be swiftest in bringing television to the villages; next to II, best equipped to cope with a failure in the space link (or microwave). Thus it may be that a country like India will find it advantageous to consider combined strategies, rather than simple ones.

VI SOME CONCLUSIONS ON FEASIBILITY

What, precisely, is meant by feasibility?

It is too simplistic to say that the feasibility of any advanced technology for a developing country is what the policy makers of that country say it is. There are many components of feasibility that underlie policy feasibility: technical feasibility, resource feasibility, functional feasibility, for instance. The technology must be workable. The required resources must be available. There must be demonstrable need. But ultimately, at the moment of truth, policy makers must decide, often on very intangible grounds: Is this a policy we can support? Is this an allocation of resources we can defend against competition for the same resources?

For the last five chapters we have been talking about feasibility, without mentioning it, and the evidence we have found leaves little doubt that any of the five strategies presented in Chapter V would be feasible for India. Feasible, that is, up to the point of the decision on policy feasibility, in which we have no wish nor any right to join.

The impressive evidence of television's effectiveness as an instrument of information and instruction, in Chapter II, and the equally impressive evidence in Chapter III of India's needs for sharing its best instruction and deepening the flow of information to its people, hardly leave room for doubt that a major expansion of television could make a profound impact on India's national development program.

In this last sentence, and in the two chapters mentioned, we have spoken only of television, not of satellites, because it is television that is going to make the impact on development. Communication satellites are only one way to deliver television, and, as we have shown in Chapter V, there are different patterns and combinations of satellites with other delivery systems for that purpose.

Most of the questions of resource feasibility are no more difficult for satellite television than for ground-based television. Certain ways of using satellites to deliver television would actually be less expensive than to deliver it from transmitters and towers on the ground. Direct broadcasting from a satellite to local receivers would require the training of fewer skilled people than ground-based television. There would be no difference in the number of receivers or village power supplies needed, and satellite television would actually require less construction, less land acquisition.

Is satellite television technically feasible? We have no reason to think that any of the five strategies described in Chapter V is technologically unworkable or impractical. Most of the technology has already been tried out, and all of it has been studied thoroughly. The later, higher-powered satellites will take some development efforts, which will be necessary whether or not they are used by the new countries. And there are still some questions about how the augmented front-ends of receivers will work for direct reception. But these

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questions are mostly about what they will cost, and what maintenance problems they may create, rather than whether they will work. The electronic engineers in this field are ahead of the social engineers, and the technical feasibility of any of the five systems can be accepted with a great deal of confidence.

Can the technological base be provided in India? That is, can a sufficient supply of receivers and other broadcasting equipment be produced? Can engineers and technicians, especially for maintenance, be produced in sufficient numbers, by the time they are needed? Will electric power be available where and when it is needed? Certainly, an adequate technological base does not presently exist. There is good evidence, however, that it can be built, and building it would itself be a contribution to the industrial development of India. Actually, the outlook for receiver production is encouraging, as we have reported. A number of the components of broadcasting equipment -- tubes, for example -- are being manufactured in India, and it is hoped that there will soon be production of transistors. A number of skilled Indian engineers have already been trained, and there is no reason why enough others cannot be, if quotas and priorities are established. India has already built one satellite ground station and is building another. There is indeed a problem in getting power to the villages. About 50,000 now have it; another 50,000 are scheduled to receive it in the next five years. But the strategies we have suggested would mean that the placing of television receivers in villages would not necessarily outrun the extension of power lines to villages for ten years. And by that time, if the rate of power extension has not been accelerated, there will be a number of local power supplies available for around $100 each.

The personnel base? We did not mean to minimize the problem of training engineers and technicians. There is a similar and demanding problem in training broadcasters. As we indicated in Chapter V, whatever strategy of national expansion of television is adopted, some thousands of engineers and technicians, some thousands of broadcasters, some tens of thousands of field workers will have to be hired and trained. This training will take years for electronic engineers. It will be -- let us hazard a guess -- of the order of a year for broadcasters and for technicians who have already learned something about their business, of the order of half a year or a little more for village level workers specializing in agriculture, a month or so for education field workers who are already teachers and have only to learn the uses of television in the classroom, and perhaps a week or so for classroom teachers who will need workshops in making efficient use of television. This will be a very large activity that will go on for some years. All the more reason to move slowly into television, so that the supply of skilled personnel can build up gradually, those already trained can train others, and opportunities for practice and internships will be available. But the point is that such a training program is by no means out of the question, and it actually would contribute greatly to India's supply of skilled persons and ultimately to the productivity of the economy.

These problems are not much different for satellite television than for ground-based television. When we came to consider the special problems of satellite television, however, the one that disturbed us most, and the one to which a country like India needs to give major attention, is what we have called the problem of heterogeneity. India is a classical case of this problem, because of its great diversity of languages, cultures, educational systems, and agricultural areas, and the location of 80 per cent of its people in hundreds of thousands of small villages. This is a challenge to the widespread use of television for education and development for which no parallel exists in the United States or most other countries of the world. It is indeed a very severe problem and is bound to dilute the effectiveness of any national information system. Actually, it would seem to call for a maximum use of local stations, local languages, local programming. The question is, then, how to combine the advantages of national programming, with all it implies for national integration and sharing the best of Indian resources with all of India -- how to combine this quality of a national information system with service to many local needs and local languages?

In Chapter IV, we therefore worked out illustrative program schedules that could be made (without any attempt to say what actually would be done) in order to use a satellite for meeting both national and local needs. The results were rather impressive. Given more than one video channel, and perhaps twice as many audio channels as video, it can be done. An astonishing amount of programming can be provided by satellite for local language, local school, local cultural groups. Obviously, it would be more efficient to use the same language, or even two languages, all the time on the satellite. But the point is, that with a certain degree of programming ingenuity and a certain amount of cooperation locally, an impressive amount of programming can be provided for local areas and local needs. The system can be designed to contribute in a maximum way to both local and national needs, too. For example, we have suggested that there be a number of production centers, in different language and cultural areas, rather than one single network production center. We are rather attracted also to the idea of a combined system, like Strategy V, in which a certain number of ground stations will contribute to local programming, and a satellite will speed the service to the villages.

Up to the point of policy decision, therefore, we conclude that the strategies of national expansion of television set forth in Chapter V are feasible for India. Some seem to us more desirable than others, and some will doubtless appeal more to Indian policy makers than will others. But when the matter comes to policy decision, there need be no real concern that these strategies are not workable, if India wants to make them work.

The question of policy feasibility is likely to rest for the most part on a cost-benefit decision, and a political decision. The sub-set of questions are likely to include these: what does it cost? can we afford it? what do we get out of it? is that worth the cost? is it something that we need more than other things? is it a policy that we can defend against competition for the same resources?

These questions lead inevitably into intangibles. We know, at least in a rough way, what such a system as we are talking about would cost. We know that making television available to about 84 per cent of the Indian people would cost in the neighborhood of $35 million a year for 20 years. At first, the annual costs would be only in the neighborhood of $10 million, and would rise until at the end they were over $60 million a year.

There are no very good rules for deciding whether a sum like this is something a country can afford. We can get some idea, however, by comparing it with certain other large sums, such as national income and expenditures on education. India's gross national product for the present year is estimated to be between $25 and $30 billions, and the expenditure on education is about $1 billion. The Education Commission has projected both national income and educational expenditures 20 years into the future from 1965-66, and this gives us an opportunity to put their projections beside our own forecasts of what satellite television would cost during the same period. For this purpose, we shall take the estimated costs of Strategy V, the combination of ground-based television and direct satellite broadcasting. It will be recalled that this is neither the most nor the least expensive of the suggested strategies.

COMPARISONS OF NATIONAL INCOME, NATIONAL EXPENDITURE ON EDUCATION, AND ESTIMATED ANNUAL COST OF EXPANDING TELEVISION OVER INDIA BY A COMBINATION OF SATELLITE AND GROUND-BASED BROADCASTING, PROJECTED OVER 20 YEARS

(in $ billions)

	1970-71	1975-76	1980-81	1985-86
National income	37.5	50.1	67.1	89.7
National expenditure on education	1.3	2.1	3.3	5.3
Annual cost of establishing and operating national television	.0046	.0193	.046	.0656
Education expenditure/ national income	3.4%	4.1%	5.0%	6.0%
Cost of national television/national income	.012%	.039%	.069%	.073%
Cost of national television/education expenditure	.35%	.91%	1.4%	1.2%

(Projections of national income and expenditure on education by Indian National Education Commission. Estimates of cost of satellite television Strategy V, from Chapter V of this document.)

How does one interpret these? It is evident that the percentages are small. But is one per cent of annual expenditure on education, or seven one-hundredths of one per cent of national income too much to spend for satellite television?

When one tries to interpret such figures in terms of cost/benefit, the evidence is not so easy to quantify. We believe it is demonstrable that it will be considerably less expensive to deliver one hour of teacher in-service training every day by television than to bring teachers into the training colleges for the same purpose. But what monetary value does one place on the contribution television might make to the national integration of India? What value does one place on being able to upgrade the smaller and more remote schools of India with expert teaching and excellent demonstrations, by television? What value does one place on being able to affect the pace of modernization -- being able to bring development information to the villages within a few years rather than a few decades? If television really can make rural life more pleasant, how does one evaluate that in economic terms? If a major expansion of television can help create a productive and profitable electronics industry for India, how important is that in the plan of development?

This is the shape of the decision. It must necessarily be based on estimates of cost/benefit, many of which are rather intangible. But ultimately India or any other country considering a system like the ones we have been talking about must make a hard political decision on national priorities and acceptable policies. And at this point even the best feasibility study becomes no longer very meaningful.

A few final words. Having seen the context in which India would have to decide upon a satellite information system, what advice would we give another developing country facing a similar decision? Let us answer very briefly:

1. Begin with needs, not with technology. The important question is whether the country needs to expand instruction and information to an extent that would justify a major system development. If the system grows out of the needs it is much more likely to be designed to meet them effectively than if it comes into being (as many television systems have) and has to look around for needs to meet.

2. Begin with television, not with satellites. The system is going to deliver television (or radio or telephone or teletype), not a satellite. The users of the system will never see the satellite, but they will see the television it brings them. There are different ways to deliver television to them, some of which, in a given situation, may be preferable to satellites. The question is, can television make a significant contribution to the country's educational and development needs?

3. If it can, compare different systems for delivering television. Work these out in some detail, including sample programming, a phasing of the expansion, and an inventory of the resources that will be

required. In particular, look at the possibility of systems that combine different methods of delivery -- for example, ground-based television and satellites.

4. If it is to be a national system, and particularly if it is to include a space link, study carefully the heterogeneity problem. How can the system best be designed and programmed to meet both national needs and local needs? It is at this point that combined systems may prove especially attractive.

5. Survey the resources. What will be required in the way of an electronics industry, engineering and technical personnel, broadcasting personnel, field personnel, electric power, transportation? If these are not available in sufficient number how can they be provided?

6. Try to solve, at the beginning, the problem of organization and control. A major system like this, with thousands of employees whose efforts are multiplied into daily national impact, requires both freedom to be creative and imaginative and a close contact with the substantive agencies of government, education, and culture that are concerned with a national information system. How can it best be organized for these purposes, and where does it belong in the control system of government?

7. Adopt, if possible, a schedule that will move the country gradually into television, a step at a time. The detailed planning, the hiring and training, the necessary manufacture of receivers and other electronic gear, the construction of stations, the work on content and curriculum, the scheduling, the making and testing of programs, the initial practice in using the new system, all of these things will take

two or three years, if done adequately, before the service goes on the air. If it can then develop in a measured way, the cost can be spread out more evenly, the experiences and skills gained in early stages can be shared with later stages, mistakes can be corrected, the most formidable problems can be mastered before they involve the whole national system. Furthermore, if the plan is so made that at any given stage it is possible to take stock and decide on the next step, then there is likely to be less waste and less dissatisfaction.

In the case of India, in particular, we have been impressed with the usefulness of a step-by-step approach. A satellite pilot project, such as INCOSPAR and NASA are considering, would be immensely useful in the first five years of system development, in order to look ahead to some of the problems of satellite hardware and programming for heterogeneous audiences, and to throw light on the decision of what kind of space link to use or whether to use one at all. If at the same time, the first ground stations, except for Delhi, could be put into operation, then valuable experience and skills could be gained with them. (It is worth considering also whether in these first five years a number of local radio stations might not be added to the system for the special benefit of agricultural programs and local village needs.) If it were possible to do these variety of things in the first five years, then India could make its further plans in the light of a great deal more experience and with greater confidence. And very little would be wasted, no matter what decisions were made at that time. The stations would go on broadcasting. The augmented receivers would continue to function if the next phase of the system included a satellite; if it did not, the front-ends could be taken off and the sets used like any other standard receivers. This is a pattern of system development that seems most promising to developing countries that are exploring such a massive and potent technology as the one we have been talking about in this document.

APPENDIX A

The Education and Information System of India: 1968

The educational system

India has taken giant strides in education since Independence. In 15 years it raised the enrollment of its primary schools (grades 1 through 5) from 19 million to 52 million; of its middle schools (grades 6 through 8) from 3 to 11 million; of its secondary schools (grades 9 through 11 or 12) from 1 to 5 million. It has more than doubled its corps of teachers, substantially increased the number of schools, and more than quadrupled its educational expenditures. Even so, however, with 70 million children and young people in school, it is still far from meeting its Constitutional goal of free and compulsory education for all children to age 14.

In 1966, 78 per cent of children of primary school age, and 32 per cent of middle-school age, were reported to be enrolled in school. The corresponding percentages were 17 per cent for secondary, and 2 per cent for higher education. The Fourth Five-Year Plan, which has been delayed and is now scheduled to begin early in 1969, has as its objective the raising of primary school enrollment to 92 per cent (69.5 million children), middle school to 47 per cent (19 million), secondary school to 30 per cent (9 million), and universities to 2.4 per cent (1.5 million). There is considerable doubt as to whether these goals are realistic.

The drop-out rate has been worrisome to many Indian educators. Nearly two thirds of all the children who entered the first grade in or shortly before 1960, have not progressed as far as the sixth, and two thirds of all those who drop out are reported to do so in the first grade -- meaning that they leave school functionally illiterate.

George Tobias has calculated that, under favorable circumstances, out of 1000 children who enter primary school in 1966, 4 per cent will enroll in middle school in 1970 or shortly thereafter; 240 will enroll in the general secondary course in 1973; 59 will be enrolled by 1976 in the general higher secondary course and 51 in the vocational higher secondary course. By 1978, 6 out of this same 1000 are likely to be enrolled in pre-university courses and 34 in college. (Tobias, table IV-6)

Despite the addition of many hundreds of thousands of teachers, the ratio of teachers to primary school pupils rose from 1:35 in 1951 to 1:49 in 1966. (The ratio at higher levels, however, is lower, and has been falling. Selected Educational Statistics, 1967) About 73 per cent of India's approximately two million teachers are listed as "trained", meaning for most of them teacher training at the level of secondary school. Just under 58 per cent of pre-primary, 71 per cent of primary, 78 per cent of middle, and 69 per cent of secondary school teachers are reported to be "trained".

Tobias forecasts the need for 779,000 additional elementary school teachers and 209,000 secondary school teachers in the period 1966-1971. In contrast to this, only a little over 70,000 were reported to be in teacher-training courses in 1966 -- 39,000 at the secondary level, 32,000 at the undergraduate level, and 900 at the postgraduate university level. (Tobias, VII-110) It appears, therefore, that many of the new teachers for India's schools, especially if enrollments are expanded, will have to come from the group characterized as "untrained".

In addition to the need to meet expected increases in school enrollments, and the need to expand and upgrade the teacher corps, there is considerable evidence of need for qualitative change in the schools. Between 1960 and 1965, 55 per cent of the students who took the examination for the university matriculation certificate, and 40 per cent of those who sat for the higher secondary examination, failed. (Report of the Education Commission, 1966, p. 246) Beyond this, increasing dissatisfaction has been expressed by the Education Commission of 1964-1966, and by Indian educational leaders, about the lack of relationship between the Indian schools and employment needs and opportunities. Tobias speaks of this quite bluntly (VIII-9). "Indian education can rightly be called a system to produce failures," he says. "From the earliest years, and disregarding a few exceptional schools, the child is groomed and advanced along a path whose natural destiny is a degree granted by a university. Few indeed on the Indian educational ladder, are the intermediate stepping-off points short of the university degree at which the student will have equipment necessary for labor market participation. Hence, the system is relatively indifferent to the career needs of the vast majority of young people who will acquire some education but not a degree."

Most children, Tobias says, are simply following the value standards imposed on them by their elders, "who urge them into occupations that carried high social and cultural prestige during the Empire." If a student finds himself in vocational school, he realizes it is probably because people felt he could not make the grade in the academic stream, and he "enters reluctantly and resentfully, without making a deliberate vocational choice." (VIII-11)

Nevertheless, the Indian Education Commission has recommended a major expansion and diversification of vocational education (e.g., p. 485). It is apparent, however, that this cannot be accomplished successfully without a broad change in attitudes, a review and revision of curriculum to fit it to realistic employment needs, the hiring of competent teachers for whom other occupations are in competition, and a substantial increase in budget, inasmuch as vocational education costs more than academic education.

In 1966-67, India was spending about 4.77 billion rupees ($636 million) on education. This averages out to about 9 dollars per pupil. However, the costs of individual instruction rise sharply from less than five dollars in primary school, to about 13 in middle, 46 in secondary, and 61 in vocational secondary. (Government figures from yearbook, India, 1967) It is, of course, hard to calculate total expenditure for education because it comes from many sources, but it is fairly safe to assume that present expenditure per pupil is at least not over 12 dollars.

The Indian Education Commission, whose thoughtful 1966 report has already been extensively quoted, and which is likely to have a great deal of influence on policy, has recommended, along with the greater emphasis on vocational studies, a new school structure, a general upgrading of teachers and teaching, and an expenditure increase of seven-fold by 1985. Taking into consideration population increases and school expansion, this would mean that India, in the view of the Commission, should be spending somewhere in the neighborhood of 30 dollars per pupil per year.

It should be noted that education in India is constitutionally the responsibility of the States, with the exception of some higher education and research. However, there is a Central Advisory Board of Education that is called upon to lay down the general educational policy, and its four standing committees have important coordinating and planning functions, respectively, for elementary, secondary, higher, and adult education. The National Council of Educational Research and Training also has important all-Union functions for in-service training of teachers, for research on education, and for the preparation of textbooks and curricula.

Literacy

Just as educational opportunities in India have much to do with the extent of literacy, so does literacy control to a great extent the use of the mass media. Therefore, let us look at literacy figures.

Two out of every three men, six of every seven women, in India cannot read and write. The National Institute of Education (Magnitude of Illiteracy in India, 1961-1981, p. 17) estimates literacy in India for the year 1966 at 28.6 per cent. The last figure derived from a Census (Report of the 1961 Census of India) is 24 per cent (34.5 for men, 13.0 for women).

Furthermore, the incidence of literacy varies greatly by States. For example, in 1961, the proportion of literates in Kerala was 46.8 per cent, and 52.7 per cent of the individuals living in the union territory of Delhi were literate. By contrast, literacy was only 11 per cent in Jammu and Kashmir, only 15.2 per cent in Rajasthan, and only 17.6 per cent in Uttar Pradesh, the largest State in India where the population is now in the neighborhood of 100 million people. In the Northeast Frontier territories, on the borders of China, the figure was only 7.2 per cent. (India, 1967, p. 62)

It is worthy of note that India bases its literacy figures on its entire population, including preschool and early-primary children. For this reason, the percentages of 24 in 1961 or 28.6 in 1966 may be unduly low. It is more meaningful to look at the figure for the population between the ages of 15 and 44, from whence much of the dynamics for national development will have to come. For this segment of the population, the Census estimate of literacy in 1961 was 30.6, and the NIE estimate for 1966 was 32.6 per cent. Beginning with age 15, however, the 1961 Census showed a steady decrease in percentage of literacy -- 42.3 for age group 10-14, 33.6 for 20-24, 21.8 for 45-59, and 16.7 for those 60 and over.

The National Institute of Education, taking into account planned expansion in school enrollments, expects the percentage of literacy for the whole population to double between 1961 and 1981 -- from 24 to 48 per cent. In 1981 the Institute expects the proportion of literates in the 15-44 year group to be 55.7 per cent. (Magnitude of Literacy in India, p. 21)

The cruel nature of India's problem is illustrated, however, by setting the increasing proportion of literacy against the growth in population. Between the 1951 and the 1961 Censuses, literacy in India rose from 16.6 to 24 per cent. During the same time, however, the general population grew so rapidly that by 1961 there were actually 32 million more illiterates in India than there had been ten years earlier!

Languages

The diversity of language is also a controlling element in the flow of communication throughout India.

According to the 1961 Census, 872 languages and dialects are spoken in India. These include at least 80 tongues spoken by more than 100,000 persons each.

The Constitution recognizes 15 official languages, written in 13 different scripts. These are: Assamese, Bengali, Gujarati, Hindi, Kannada, Kashmiri, Malayalam, Marathi, Oriya, Punjabi, Sanskrit, Sindhi, Tamil, Telegu, and Urdu. The 1961 Census estimated the number of speakers of these languages (with the exception of Sanskrit) as follows:

Language	Regions where spoken	Thousands of speakers
Assamese	Assam	6,804
Bengali	West Bengal	33,754
Gujarati	Gujarat	20,106
Hindi	Northern States	123,025
Kannada	Mysore	17,306
Kashmiri	Kashmir	1,904
Malayalam	Kerala	16,995
Marathi	Maharashtra	32,767
Oriya	Orissa	15,610
Punjabi	Punjab	9,867
Sindhi	Enclaves of persons relocated from West Pakistan	1,472
Tamil	Madras	30,465
Telegu	Andra Pradesh	37,643
Urdu	Northern States	23,323

These official languages, together, reach about 98 per cent of the people of India. By origin, they fall into two groups: the Dravidian tongues of the earlier non-Aryan inhabitants who were pushed to the south of India by the Aryan invaders, and the Indo-European languages of these later arrivals, now spoken mostly in the northern parts of India. In addition to these families, there are two other branches. Between 12 and 13 million people probably speak the Austric tribal languages, and the Sino-Tibetan languages found near the northern borders of the country. Perhaps another six million people speak foreign languages.

Thus Hindi itself reaches only about one third of the people of India. With Urdu, to which it is closely allied, it reaches about 40 per cent. The Indo-European languages together reach about 70 per cent of Indians, the Dravidian languages nearly 30 per cent. But with the exception of Hindi and Urdu, these languages are quite separate in form and nature, and for the most part written in different scripts. Between the Indo-European and the Dravidian tongues there is not only the barrier of completely different language structure, but also the cultural sensitivity of people who live in southern as opposed to those who live in northern India, and value their language as a sign of their independence and their different history.

English is spoken by perhaps 5 million Indians. An accurate figure is very hard to come by. Because this language was the vehicle for communication with the colonial government and for the discussions that led to independence, and because it is spoken by most of the national leaders and many of the top civil service employees, it might be expected to bridge the gaps among the other languages and provide a lingua franca for a most multi-lingual country. However, Article 343 of the Constitution provided that "the official language of the Union shall be Hindi in Devnagri script. The form of numerals to be used for the official purposes of the Union shall be international form of Indian numerals." The acceptance of Hindi for official purposes, however, has been bitterly opposed by South Indians who find it neither easy to learn nor desirable to speak. Therefore, the Lok Sabha (Indian Parliament) found it necessary to adopt the Amendment of December 16, 1967 which stipulated that either Hindi or English would be compulsory for recruitment to central government service, but that correspondence in English was required only between the Union and a non-Hindi speaking State. English translation would be provided with original Hindi communications to non-Hindi States, and translations in Hindi would have to accompany English communications to the central government or a Hindi-speaking State. Thus English hangs on, but Indians feel the need of an Asian language, or languages, for official purposes, and are moving toward the greater use of regional languages even in higher education, where English had formerly been used. The current Minister of Education has advocated the translation of textbooks into all the regional languages, although it will take a long time to reproduce in these languages the resources that now exist in libraries in English.

The separatism of languages in India has been aggravated by the policy of "Sanskritizing" Hindi. Hindi is made up not only of words from the original Sanskrit roots, but also some terms borrowed from Arabic, Persian, English, and a few other languages including the Portuguese spoken in Goa. For a number of years, now, a group of purists have been replacing the non-Sanskrit words of Hindi with new words coined from Sanskrit roots This kind of "purified" Hindi is, of course, different from the Hindi used in films or in everyday speech. When it is used on All India Radio, in official documents, or in books, these new words serve as further barriers to the efficiency of Hindi as the link language that the authors of the Constitution expected it to become.

Mass media -- newspapers

India has had a newspaper press since 1780. It is at present remarkably vigorous and relatively free from Government interference, though it reaches a relatively small segment of the population.

There were 601 dailies in 1966, with a total circulation of 6,320,000 (Hindustani Year Book, 1968). These appeared in 20 languages, the greatest number being in Hindi (167), with Urdu next (83), and English third (61). Among non-dailies, there were 2,403 weeklies, and 5,636 papers published less frequently than weekly, with a total circulation of about 15,000,000. The number of non-dailies by the chief language groups were:

Hindi	1931
English	1843
Urdu	785
Bengali	550
Gujarati	514
Marathi	490
Tamil	414

English-language papers, however, had the largest circulation. According to the India Yearbook, 1967, circulations by language were:

English	5,559 (thousand)
Hindi	3,913
Tamil	2,707
Malayalam	1,698
Gujarati	1,470
Marathi	1,361
Bengali	1,243
Urdu	931
Punjabi	243
Oriya	128
Sindhi	102
Assamese	63
Telegu	45

Fourteen of the dailies, eight weeklies, and four less-than-weeklies had circulations in 1966 of over 100,000 each. The largest circulation among dailies belonged to the Ananda Bazar Patrika (Bengali), which stood at 177,242. Among the weeklies, Kumundam (Tamil) claimed a circulation of 326,000. Influential English language papers like the Times of India, the Hindu, and the Statesman had circulations in the neighborhood of 100,000 each.

These relatively low circulations in a country with such an enormous population (dailies circulated only about 16 copies per 1,000 people), reflect the literacy levels and the language fragmentation. To some extent it reflects also the even greater difficulty of delivering papers in rural areas. For example, the Indian Institute of Public Opinion estimated that 83.6 per cent of the urban rural literates they sampled in 1961 read (but did not necessarily buy) newspapers, but that only 43.8 per cent of rural literates read them. They estimated the average readership of a single copy of a newspaper at 7.8 individuals, or 9.3 including those who had the paper read to them.

In 1966, 230 dailies which reported on their employees had 3,149 correspondents, including 76 in other countries. The 294 papers who listed their writing and editing employees said that they employed altogether 2,817 journalists, among them only 15 women; 284 of these same papers also listed a total of 22,198 managerial and housekeeping employees.

Indian papers are served by two principal Indian news agencies -- the Press Trust of India (PTI), which came into existence to replace the Associated Press of India; and the Union News Agency of India (UNI), which replaced the United Press of India. News is circulated on teletype largely in English alphabet and mostly in English language. One agency only puts Devnagri script (for Hindi) on teletype. This creates a translation problem for most non-English papers.

Films

From 1913 to the present day, India has been producing films, and today it has one of the largest film industries in the world. Annual production of feature films usually runs between 300 and 320.

The capital invested in the industry is estimated to be about $900 million. More than 125,000 persons are employed -- 20,000 in production, 10,000 in distribution, 85,000 in exhibition, and 10,000 in allied jobs such as film publicity. The annual attendance of films in India is about one billion, and the annual gross is about equal to the total capital investment -- $900 million.

Films are made in most of the official languages of India. In 1966, these were the chief languages represented:

Hindi	108 (films)
Tamil	60
Telegu	41
Malayalam	31
Bengali	30
Kannada	21
Marathi	12

There were also a few in Assamese, Punjabi, Gujarati, Oriya, Nepalese, Sindhi, and other tongues. (Hindustani Yearbook, 1968)

Every film house in India is required to show, along with a feature film, up to 2,000 feet of film "approved by the authorities as documentary films, films of scientific and educational value and films dealing with news and current events," and to pay a rental on them "not exceeding one per cent of the average weekly net collection" (India Yearbook, 1967). The government releases alternately a short film and a newsreel each week, for these purposes.

Radio

Broadcasting in India dates back to 1924. All India Radio was organized and named in the late 1930's when the importance of national broadcasting began to be evident. AIR had only six stations when the Second World War broke out in 1939, and only 11 when the Ministry of Information and Broadcasting came into being in 1947. Now the radio service is recognized as a responsibility of the Union government, and operates as a part of I and B. There are at present 36 stations, 25 area centers, 26 Vividh Bharati (light program) centers, 90 medium-wave and 31 short-wave transmitters. These cover about 52 per cent of the area and 70 per cent of the population of the country, with medium wave. The Fourth Plan has set a goal of reaching 70 per cent of the area and 80 per cent of the population.

The last official count of receiving sets, in December, 1966, showed 6,483,896. The number is now estimated by AIR at about 8 million. Many of these are transistorized receivers. About 119,000 of them are community receivers partially subsidized by the Union government. This means that at least one fifth of India's villages, and probably more, have some access to radio broadcasts.

AIR's service includes 12 to 13 hours of the light program (Vividh Bharati) each day, and 11 to 12 hours of "home service". The home service is broadcast in 20 languages -- the official ones plus English, Dogri, Nepali, Tibetan, and Konkani. If this seems like a difficult restriction on programming, note should be taken that some air time is given also to 57 dialects, to 87 Adivasi (tribal) languages, and to 21 foreign languages in the external broadcast services.

Fifty-nine news bulletins per week originate from the central studios. Regional news originates from 19 stations in 14 languages. The regional programming has been analyzed as follows:

Indian music	44 per cent
News	22
Special programs	13
Talks, discussions	8
Rural broadcasts	6
Drama, features	5
Western music	2

The percentages do not add up to 100 because the decimal fractions have been omitted. (Source of all these figures is All India Radio.)

Education receives about 1.19 per cent of regional time, according to 1967 figures from AIR, and most of the broadcasts are designed to be supplementary to, rather than integral with, classroom syllabi. Agriculture and community broadcasts are given about 5.69 per cent of regional time. These are the broadcasts that service the well-known Indian Radio Rural Forum, which was tried and proved highly successful in villages around Poona in 1954, and later was extended widely through the country. The broadening of these forums was never as successful as the pilot project, however, doubtless because less support was put behind the extended forums than had been given the pilot ones. There are now said to be 15,000 forums, but as many as half of them are believed to be inactive. (For a discussion of the effort to broaden the forum activity, see New Media in Action, I, 105-134.)

The extraordinary proportion of broadcast time given to Indian classical music reflects both the difficulty in providing any other kind of common broadcast experience for a country so divided linguistically, and also the determination of policy makers to support native music and musicians. No fewer than 2,310 staff artists were on the payroll of All India Radio, as of 15 March, 1967. (AIR, Important Facts at a Glance, p. 3)

Approximately 8,000 regular employees are on the payroll of AIR. The budget of the service for 1967-68 was 83,353,000 rupees ($11.1 million). Chief source of this money was license fees for receivers, which in 1967 totalled a gross of 87,100,000 rupees ($11.6 million) and a net (after collection expenses) of 71,785,000 rupees ($9.6 million).

The Chanda report, a thoughtful and hard-hitting study of India's broadcasting system and policy submitted in 1966 by a national committee under the chairmanship of Asok K. Chanda, spoke bluntly about "scanty allocations" to AIR. Said the committee: "In the First Plan the allocation to broadcasting was about one-tenth of one per cent of total resources. In the Second Plan it was two-tenths of one per cent and in the Third it was reduced to one-eighth of one per cent. These scanty allocations have been made despite the realization by the [Planning] Commission that the success of the plan rests on a variety of factors -- on widespread understanding of the challenge and burdens of development, on the release of new productive forces and increasing application of modern science and technology, on changes in outlook and motivation and, finally, on a climate of confidence that rapid economic development is the means both to social justice and to wider economic opportunity. It is difficult to reconcile this postulate with the treatment given to radio which would have gone a long way, under present conditions to bring about the psychological transformation the Commission seeks." (Radio and Television: Report of the Committee on Broadcasting and Information Media, 1966, p. 10)

Perhaps reflecting this point of view, the Fourth Plan tentatively allocated 430,000,000 rupees ($57 million) to All India Radio, between five and six times the allocation in the previous plan. This included an expansion of television to five metropolitan areas. It remains to be seen, however, whether these allocations will materialize.

Among its other recommendations, the Chanda Committee came out strongly (as had the previous Bhagavantam technical committee in 1965) for placing All India Radio under a public corporation rather than under the Ministry of Information and Broadcasting, and for a considerable reduction of the time devoted to Indian classical music in favor of more time to education and developmental programs.

In 1960, 1962, 1964, and 1967, the Indian Institute of Public Opinion interviewed samples of the Indian urban public, and found in different years proportions of 66 to 98 per cent of the people in their sample who reported that they listened to radio regularly. The 98 per cent figure was obtained in 1967 from a study of literate urban adults, and suggests that radio fails to reach hardly anyone in this group. No precisely corresponding figures are available for rural listening, but in 1964 a survey obtained program preferences of urban and rural listeners, which were as follows:

In general what kinds of radio programmes do you like to listen to?

	Urban	Rural
News bulletins	79 per cent	93 per cent
Indian film music	78	64
Plays	58	13
Indian classical music	40	6
Sports programmes	36	10
Variety programmes	26	13
Women's programmes	23	8
Political commentary	18	4
Talks and discussions	15	21
Western popular music	15	..
Western classical music	9	2
Science programmes	9	2

(Monthly Public Opinion Surveys, 148, 1968, p. 26)

Television

Since September 15, 1959, India has been experimenting with a small television service in Delhi. The station has a Class A coverage radius of about 25 miles. Within that circle there are somewhere between 5,000 and 7,000 receiving sets, most of them in the city of Delhi itself. A number are in schools which are provided with six 20-minute periods of integrated instructional programming (in English language, general science, chemistry, and physics) each day, and 80 of them are in villages where teleclubs have been organized to watch and discuss the agricultural broadcasts that are presented twice a week, as part of the daily 90-minute general service. The total service is now about 21 hours a week.

Inasmuch as the Delhi operation has been regarded as an experiment in television, before the service is extended more widely, great interest attaches to its results. Two studies by Dr. Paul Neurath have been made of the school broadcasts. He reported in 1965:

> "Students are learning more or better with television than without television. They see more and better experiments and they see them in more detail than their own classroom teachers can provide in most schools in Delhi with present laboratory space and equipment. Some of the experiments shown on television even the best schools could not provide. There is slight overall superiority, of the results of the students in TV schools, over those

> of students in non-TV schools. A change in attitude and action taken is percolating through the whole school system, upwards from the teachers and backwards from the Director of Education." (Neurath, 1965)

In January, 1968, the Audience Research Service of AIR surveyed 26 of the 80 villages where community receivers had been placed, to find out something about the reception of Krishi Darshan, the agricultural program. They found that two thirds of the adults who belong to teleclubs, and two fifths of adults who do not belong, say that they view the agricultural broadcasts regularly. "Yesterday" two fifths of the members and one-sixth of nonmembers had seen the broadcast. Of the club members, 72 per cent reported that discussions were held regularly, following the programs. They were asked which were their main sources of information about new methods in farming. The main source, they said (just under 50 per cent of them) was the Village Level Worker. However, 37 per cent of them had learned some kind of innovation from the television. Other sources were the Block Development Officer (18 per cent), Radio (8.6 per cent), and the Agricultural Extension Officer (5 per cent).

What made them put new methods into practice? The answer was much like the previous one. Forty-eight per cent said they took the advice of agricultural officers; 33 per cent said they saw on television that these methods would give better yields; and 20 per cent were influenced by the example of their neighbors. (Survey Report: Krishi Darshan, p. 9)

These relatively encouraging results were supplemented by a study of home viewing, made by S. C. Parasher in January, 1967. Interviewing a sample of 387 adult owners of television receivers, he found that about half the sample, 47 per cent of the men, 53 per cent of the women, said they viewed television daily. Their preferences for program types were in this order: feature films, short plays, sports, serial plays, and news. On the previous day, however, it was a serial play that got overwhelmingly the highest viewing. (Parasher, 1967)

On the basis of evidence such as the above, AIR has decided that its television service, despite its limited nature and small production budgets, is attracting considerable audiences and proving useful both in school and in the village. The organization is therefore pushing for the long-planned extension of television to at least four other large cities: Bombay, Madras, Calcutta, and Kanpur.

Telecommunications

In the last year for which figures have been published on telephone services (1966), India had 766,000 telephones -- about 1.6 for every thousand people. The number is now estimated at about 900,000. The number of telegraph offices in 1966 was 114,000. These include licensed offices, which are operated by other than government personnel. The Indian telegraph service is said to be the oldest government-owned public utility in the world; it dates from 1853. The number of post offices in India was 96,895 on 31 March, 1965.

This means, of course, that relatively few villages have post offices (or telephones or telegraph offices), but, on the other hand, there are approximately 150,000 letter boxes served with regular deliveries in rural regions. For the year 1966-67 the Indian postal service is estimated to have handled nearly 6 billion postal articles of all kinds. For the same year it is estimated that 45 million telegrams were sent. (Hindustani Yearbook, 1968, p. 424)

The All India Radio service does not operate by means of the conventional microwave or coaxial cable network, but rather by rebroadcasting programs off the air. Presently operating microwave circuits total about 2300 kilometers (1390 miles), and reach from Calcutta to Assam, Calcutta to Kharagpur, between Ambala, Simla, and Chandigarh, and from Srinagar to Jammu. Another 1300 kilometers are scheduled to be completed in 1968 or soon thereafter. These include, among others, a circuit from Delhi to Jaipur, and one from Poona to Secunderabad. The Fourth Plan provides for adding another 8500 kilometers to the country's microwave links.

Coaxial cables already span more than 5,000 kilometers (3,000 miles), and include the important connections between Bombay, Delhi, and Calcutta, Delhi and Jullundur, and Bombay and Madras. Construction has already started or is expected to start soon on nearly 4,000 additional kilometers of coaxial connections, and another long list of cable connections is scheduled under the Fourth Plan.

An experimental satellite communication earth station, under the administrative and technical control of the Indian National

Committee for Space Research, has been built about 12 km. west of Ahmedabad. This station is intended for experiments in tracking and operating with communication satellites, for research, and for training engineers and technicians in the field. The Overseas Communications Service of the India Post and Telegraph Service is setting up another earth station in order to communicate with the Indian Ocean satellite and thus to participate in the global Satellite Communication System operated by Intelsat. This station will be located at Arvi, which is about 80 kms. north of Poona and about 200 kms. east of Bombay. India is a member of Intelsat, and has been assigned a quota of just under one half per cent (.480624) of the capital cost.

Transportation

India's railway system, more than 59,000 kms. (35,000 miles) long, is the largest in Asia. Every day about 6 million people ride the trains in India. The amount of surfaced roads has risen in ten years from 113,000 to 284,000 miles. There are also about 675,000 miles of unsurfaced roads. Even so, however, perhaps only one third of India's 568,000 villages can be reached by road, and there are only about 700,000 motor vehicles of all kinds (including about 300,000 passenger cars) in India, because manufacture has been assigned to a few Indian firms and imports have been restricted. Pedestrians, carts drawn by bullocks or horses, and, in the cities, bicycles, are rather more likely to be encountered than automobiles on Indian roads. There are also about 5,000 miles of inland waterways, and India maintains a domestic airline which connects the major cities, as well as an international airline flying from four major airports at Delhi, Bombay, Calcutta, and Trivandrum.

Development field staffs

India has a large and vigorous community development program under the Ministry of Food, Agriculture, Community Development and Cooperation. This has been described as a program "of aided self-help . . . to be planned and implemented by the villagers themselves, the Government offering only technical guidance and financial assistance." (Hindustan Yearbook, 1968, p. 484). To provide the technical guidance this program involves upwards of 36,000 village-level workers, and smaller numbers of agricultural extension workers, health officers, and social education workers, most of them employed by the individual States.

This field staff, which, large though it seems, still furnishes less than one field worker for every 15 villages in the country, works within a hierarchy of local policy and administrative units. Development Committees in each State are responsible for implementing the program. Each State is divided into a number of Districts, and these in turn into Development Blocks, each of which contains on the average about 100 villages, a population of 60 to 70 thousand, and an area of 150 to 200 square miles. At the District level there is an elected policy group called a Zillah Parisad. At the Block level there is another elected group called a Block Panchayat Samiti. The Block

Development Officer and approximately eight extension officers work under the direction of this Samati. At the Village level, the elected Panchayat (village council), the cooperative and the school, if any, are the institutions expected to carry the brunt of development, and the chief development worker is the village-level worker. Each V.L.W. is supposed to work with five to ten villages, depending on their size and distance.

Thus it is apparent that the village-level workers are still too few to serve more than about half the villages of India, but nevertheless this structure of elected development organizations and trained (albeit some of them are reported to be inadequately trained) development field workers provides a strong channel of communication into rural communication, and a supplement and ally to any development program in which the mass media are asked to play a part.

APPENDIX B

Blueprints for Satellite Television in India

Television's potential for swiftly expanding the communication system and contributing to education and national development has caught the imagination of many people, inside and outside India. As a result, a number of designs and plans have been advanced, many of which are still under active consideration. It may be useful as background briefly to review some of these plans, with no attempt to consider technical detail or to pass judgment on them.

INCOSPAR-NASA project

Cooperating teams from the Indian National Committee on Space Research (INCOSPAR), and the U.S. National Aeronautics and Space Administration (NASA), have met several times in the process of preparing a proposal for experimental use of one of the later ATS satellites to be launched by NASA. Final details of this project have not been officially worked out and announced, as yet, but preliminary papers have discussed a pilot project of one-year duration, with one earth station (Ahmedabad), three VHF transmitting stations (perhaps Delhi, one near Ahmedabad, and a third location to be selected to rebroadcast the satellite's signals to about 3,000 conventional receivers, while direct broadcasts from the satellite would be received on 2,000 special dish antennas and suitably augmented receivers). The total cost for the equipment has been estimated to be $6.6 million, which would be reduced by approximately $2.5 million inasmuch as an experimental earth station already exists at Ahmedabad, and a VHF station at Delhi. It should be noted, too, that these estimates do not include the costs of the satellite or launching, or operating the system for a year. They also use American figures for the additional equipment to be placed on direct broadcast receivers. Freight, import duties, and Indian conditions might increase this latter cost.

To sum up, then, this project would upgrade the Ahmedabad earth station to program and handle television, add three VHF rebroadcast stations serving about 1,000 receivers each, and test out direct broadcasting from satellite to 2,000 special school or village receivers for a trial year. The capital cost would be in the neighborhood of six and three quarters millions of dollars, or about four and a quarter millions "out of pocket" when expenditures already made are deducted.

Some Indian system estimates

In a paper prepared for the Vienna Space Conference of 1968, a member of the staff of INCOSPAR and of the joint NASA-INCOSPAR planning team, has estimated the costs of delivering television to India by different means (Vepa, Satellite Television: A System Proposal for India, 1968). In one set of figures he includes the cost of 616,000 receivers -- one for each village plus 10 per cent additional for quick maintenance --, and of microwave connections if any. He also estimates the annual maintenance cost of the equipment.

To cover the entire land area by ground-based transmitters, with microwave interconnection, he concludes, would cost about $394 million in capital investment. The annual maintenance would be about $26 million.

If a communication satellite were used in place of microwave to link ground stations together, and two earth stations were provided to send signals to the satellite, the capital cost, according to Vepa, would be about $325 million, with an annual maintenance of about $22 million.

If only five VHF rebroadcast stations were built, in the areas where population is most dense, and all other receivers were served by direct broadcast from the satellite, Vepa calculates a cost of $224 million with $9.5 annual maintenance.

If the entire task were done by direct broadcast from the satellite, the estimated cost is almost exactly the same -- $224 million with $10 annual maintenance. These estimates, of course, are not intended to be reliable enough to permit a comparison on the basis of a difference as small as one half per cent of the total. Therefore, the import of Mr. Vepa's figures are that he considers that the use of direct broadcasting from a satellite would considerably decrease the capital cost of delivering television to all of India's villages.

It is perhaps important to note that the primary thrust of the so-called INCOSPAR-NASA plan is to reach the villages by direct reception from a satellite.

The Unesco team's plans

The Unesco team which visited India in November and December of 1967 suggested a possible configuration which was calculated to cost in the neighborhood of $50 million. This included two earth stations (Ahmedabad and Delhi), four rebroadcast terminals (Kanpur, Calcutta, Bombay, and Madras), and 50,000 receivers (15,000 of them specially equipped to receive broadcasts directly from the satellite). In comparing this plan with the apparent scope of the NASA-INCOSPAR project, it should be noted that the Unesco plan includes satellite development, procurement, and launching costs, one more earth station, one more rebroadcast terminal along with ten times as many receivers. Programming facilities for the system would apparently be at Ahmedabad and Delhi. Furthermore, whereas this is called a pilot project, it is not limited to one year of operation. It assumes, apparently, that the satellite would be acquired as a part of the project, and used as long as it functions properly. It would be a "pilot", therefore, in the sense of trying out new techniques, but would not be limited in time. (Preparatory study of a pilot project in the use of satellite communication for national development purposes in India, 1967)

Three university studies

Three studies at American universities within the last three years, without benefit of field work in India, have designed possible configurations of satellite television systems for the country.

The first of these was done at Stanford in 1966 at the request of Unesco (Horley, Linvill, Peterson, and Schramm, "A Pilot Test of an Educational Satellite: Technical, Economic, and Programmatic Considerations, 1966"). Its cost estimates included development, procurement, and launching of the satellite, cost of receivers, and also annual operating costs, including programming. These latter figures were based on average costs of television programming elsewhere, rather than on specific Indian experience and salary levels. At Unesco's suggestion, the number of receivers in the design was kept quite small.

This study considered the alternative of FM broadcasting from the satellite directly to village and school receivers, and AM broadcasting from the satellite to rebroadcast terminals on the grounds which would in turn serve conventional receivers. Under each of these alternatives, several sub-alternatives were suggested, which we shall briefly tabulate.

Direct broadcasting by FM

(a) One-channel service to 5,000 individual receivers. Capital cost $24.8 million. Cost of operating for five years, including programming, $7.8 millions.

(b) One-channel service to 3,000 individual receivers, and to three rebroadcast terminals serving 2,000 conventional receivers. Capital cost, $26.1 million. Five years of operation, $12.5 million.

(c) Two-channel service to 5,000 receivers, plus four channels to six rebroadcast terminals serving 3,000 conventional receivers. Capital cost, $48.2 million (partly because of a larger, more powerful satellite). Five years of operation, $20 million.

Rebroadcast through ground terminals served by AM from satellite

(d) One-channel service to six rebroadcast terminals, serving 5,000 receivers. Capital cost, $24.5 million. Five years of operation, $15 million.

(e) One-channel service to 20 rebroadcast terminals, serving about 500 receivers each. Capital cost, $40.9 million. Five years of operation, $40.2 million.

A second study at Stanford (ASCEND -- Advanced System for Communications and Education in National Development, 1967) was made by advanced students in engineering and other fields in 1967. This suggested the use of a large satellite capable of generating 1,000 watts RF power, and furnishing three channels of television service, although it was suggested that only one channel probably would be used in the first year or two. Meanwhile, if desired, the other channels could be used to provide about 3,000 telephone circuits or their equivalent in other telecommunication uses. The system was planned to cover all of India, and to serve about 1,120,000 receivers. The great number of receivers is responsible for much of the difference between the projected cost of this system and the other estimates already cited. About 980,000 of the receivers would be served directly from the satellite, and 140,000 from 47 rebroadcast stations to be located at appropriate places throughout the country. For this elaborate system, the capital investment was estimated at $507 million, with perhaps another $60 for development costs. Annual operating costs, including programming and maintenance, were estimated at $94 million.

A similar study was made in 1967 by students at the University of West Virginia (STRIDE -- Satellite Television Relay for India's Development and Education, 1967). This system was conceived of as reaching about 500,000 sets, with direct broadcasting from the satellite, at a total capital cost of $175.5 millions. The alternative of rebroadcasting through ground terminals is considered, and thought to be presently preferable in large cities, but the authors feel that direct broadcast by FM will prove, in the long run, to be preferable even for the cities.

Commercial plans

At least three provisional system designs have been presented by industrial organizations. Since these might form part of negotiations with potential purchasers, and therefore contain proprietary information, we shall not discuss them in detail.

Westinghouse Electric International presented a plan for covering most of India from seven transmitters carried in airplanes -- much the same system as has been used until recently by the Midwest Project on Airborne Television. Seven airplanes would therefore be needed, with three spares recommended. Calculating that these would operate five hours a day, five days a week, capital costs were estimated at about $30 million (plus receivers, plus ground programming facilities) and annual operating costs (for the airborne transmitters) at about $25 million. (Airborne/Satellite Television in Developing Countries, 1966)

General Electric presented a system design for a large satellite which would have four channels of television, each with five audio channels. This service would be rebroadcast through 1400 low-power ground stations (costing about $30,000 each) to low-cost portable receivers (estimated at $150 each). Total capital costs of this system are estimated at about $91 million, including $35 million for development, but not including cost of receivers. (Television Distribution for Developing Nations: Preliminary Report, 1967)

Hughes Aircraft, the company which designed and built the first synchronous satellites, presented a four-step plan, as follows:

(a) Using the existing NASA ATS-3 satellite, if possible, a pilot program would be conducted. Equipment at the Ahmedabad earth station would be improved and supplemented to carry television. Two medium-power VHF stations (in addition to Ahmedabad) -- a new one at Lucknow or Kanpur, and the present one at Delhi -- and four low-power stations for village areas would be used to receive signals from the satellite and rebroadcast them to conventional receivers, of which 1,000 color and 4,000 black and white would be provided. Using rather minimal cost figures, the capital investment of this pilot program is estimated by Hughes at about $2 million.

(b) In a second step, the ATS-3 would be replaced in the system with a new Hughes HS-310. The Ahmedabad station would be further expanded to transmit as many as six carriers to the satellite, VHF redistribution stations would be built in 20 additional large cities, 500 low-power redistribution stations would be put in strategic locations, and 20,000 school and community sets would be served direct from the satellite through 10-foot dish antennas. About 100,000 receivers would be required. Total capital cost of this two-year phase was estimated at about $38 million.

(c) During the next phase, there would be further expansion of the Ahmedabad station, the large VHF stations would be upgraded to handle more channels, direct reception would be established in 30,000 more schools and communities, 500 low-power redistribution stations would be added, and 200,000 more TV sets would be provided. Capital investment during this period would be about $42 million, of which about half would be for receivers (if black and white receivers are used, and if, as Hughes estimates, they can be produced in India for $100 each).

(d) In the next five years, an additional capital investment of $72 million would add six regional programming centers, upgrade existing VHF stations to carry more channels, put direct reception into 50,000 additional schools and communities, add 500 more low-power redistribution stations and provide 300,000 more receivers.

The total capital cost of the entire Hughes program is estimated at $154 million (development costs, operating and maintenance costs are not included, and no estimate is made of programming costs).

If this program were carried through, there would be at the end of about 10 years, an earth station able to handle six channels, six regional programming centers in addition to Ahmedabad, 23 VHF redistribution stations able to handle multiple channels, a little over 1,000 low-power VHF redistribution stations, 100,000 television installations in villages and schools for direct reception from the satellite, and about 500,000 receivers (Educational Television Satellite Distribution System for India, 1967).

COMSAT study

The Communications Satellite Corporation, in 1966 and 1967, made a study of the probable design and cost of a system for delivering educational television to India. We have been shown this study on a privileged basis, and therefore are not in position to quote it.

It is a very interesting study, however, among other things because the tentative system design was for a pilot project of a size comparable to that proposed by the Unesco team. Two ways of delivering the television were compared -- by rebroadcast from 20 stations, with signal receiver and retransmit facilities; and by direct broadcast to receivers. The estimates (and we must emphasize that these were tentative, and COMSAT has kept the study for internal use) were not far from the Unesco estimates, and about two-thirds of the total was cost of satellite and launch. (Educational Television via Satellite, 1967)

Summary

These plans deserve consideration in detail. Many of them are highly ingenious, and suggest ways in which technical difficulties can be overcome and directions that India's own planning might take. But this is not the place for such consideration.

Rather, we should note several things about these plans and designs. For one, a number of very able engineers apparently have no doubt about the technical feasibility either of nation-wide television, or of the use of a satellite in such a system. It is interesting to note also, despite the many diversities of the plans, a certain consensus in the way they have worked the satellite into the system, if they have recommended a satellite. All except two plans recommends a combination of direct broadcasting from the satellite and rebroadcasting through ground terminals. The GE plan is built entirely around rebroadcast from low-cost ground terminals, and the West Virginia University study suggests that as direct FM broadcasting develops it will prove preferable to use that entirely, though for the present it would be desirable to use rebroadcast stations for the most densely populated areas. The Comsat study did not make a recommendation. The others all think in terms of a combination system, although the proportions of direct to rebroadcast service vary greatly from plan to plan. It should also be added that some of the studies (e.g., Vepa, Horley, Comsat) consider the desirability of different alternatives, with or without direct broadcasting, all of which apparently are considered to be technically possible, whether or not desirable for other reasons.

A number of the studies apparently concluded that India would need multiple channels for its television. The Hughes study suggested six, the GE study four, ASCEND three, and Horley, et al, two. In all fairness, it must be said that some of the plans (like the INCOSPAR-NASA and the Unesco Team report) were viewed as pilot projects only, and the possibility of adding additional channels at later stages of the project although not precluded was not considered.

The modal lead time for development, manufacture, and positioning of the space system was about three years, with the suggestion that it might be more for the more sophisticated satellites, less for the simpler ones. For example, the pilot phase of the Hughes plan suggested use of the ATS-3 satellite, which is now in orbit. It would take more time, though, for the HS-310 satellite which was to replace the ATS-3 in later phases of the plan.

The considerable variations in cost estimates and in the size and nature of the systems probably reflect the uncertainties of applying a new and sophisticated technology to a developing region, but also suggest that there may be considerably different assumptions (or perhaps lack of assumptions), as to how a television system (or a satellite television system) might fit the needs and goals of India.

APPENDIX C

Additional Data about India

INDIAN CENSUS, 1961

Population, Area. etc.

INDIA ..	439,234,771	Variation (1951-61) ..	77,641,652
Males ..	226,293,201	P.C. of increase (1951-61) ..	21.51
Females ..	212,941,570	Density per sq. m. ..	370
Rural ..	360,298,168	No. of towns ..	2,690
Urban ..	78,936,603	No. of inhabited villages ..	567,169
Area (sq. m.) ..	1,178,995	No. of uninhabited villages ..	54,891
Urban population (p.c.)	18.0		
Rural population (p.c.)	82.0		
Females per 1,000 males ..	941		

Birth rate (per 1,000) ..	40.9	40.0
Death rate (per 1,000) ..	27.4	18.0
Female pop. (p.c.) ..	48.6	48.5

Expectation of Life at Birth (General)	32	45
Literacy rate :		
General (p.c.) ..	16.6	24.0
Male (p.c.) ..	24.9	34.4
Female (p.c.) ..	7.9	12.9

(Source: Hindustan Yearbook, 1968)

Population of India, States & Territories, 1961

	Area in sq. m.	Population	Population per sq. m.
India	1,178,997	439,234,771	370
States			
Andhra Pradesh	106,286	35,983,447	339
Assam	47,091	11,872,772	252
Bihar	67,196	46,455,610	691
Gujarat	72,245	20,633,350	286
Jammu & Kashmir	-	3,560,976	-
Kerala	15,002	16,903,715	1,127
Madhya Pradesh	171,217	32,372,408	189
Madras	50,331	33,686,953	669
Maharashtra	118,717	39,553,718	333
Mysore	74,210	23,586,772	318
Nagaland	6,366	369,200	58
Orissa	60,164	17,548,846	292
Punjab	47,205	20,306,812	430
Rajasthan	132,152	20,155,602	153
Uttar Pradesh	113,654	73,746,401	649
West Bengal	33,829	34,926,279	1,032
Territories & other Areas			
Andaman & Nicobar Is.	3,215	63,548	20
Dadra & Nagar Haveli	189	57,963	307
Delhi	553	2,658,612	4,640
Goa, Daman & Diu	1,426	626,667	440
Himachal Pradesh	10,885	1,351,144	124
Laccadive, Minicoy and Amindivi Is.	11	24,108	2,192
Manipur	8,628	780,037	90
NEFA	31,438	336,558	11
Pondicherry	185	369,075	1,995
Sikkim	2,744	162,189	59
Tripura	4,036	1,142,005	283

(Source: Hindustan Yearbook, 1968)

RURAL AND URBAN POPULATION (1921-1961)

Percentage of total population	1921	1931	1941	1951	1961
Rural	88·8	88·0	86·1	82·7	82·0
Urban	11·2	12·0	13·9	17·3	18·0

STATE/UNION TERRITORY-WISE DISTRIBUTION OF TOWNS ACCORDING TO POPULATION (1961)

State/Union Territory	1,00,000 and over	50,000 to 99,999	20,000 to 49,999	10,000 to 19,999	5,000 to 9,999	Less than 5,000	Total
INDIA	**107**	**139**	**518**	**820**	**847**	**268**	**2,699**
States							
Andhra Pradesh	11	9	51	73	72	7	223
Assam	1	2	10	12	24	11	60
Bihar	7	7	33	52	46	8	153
Gujarat	6	9	43	54	60	9	181
Jammu & Kashmir	2	—	1	4	6	30	43
Kerala	4	5	31	33	18	1	92
Madhya Pradesh	6	6	35	57	98	17	219
Madras	9	19	61	119	95	36	339
Maharashtra	12	15	47	89	88	15	266
Mysore	6	9	34	81	64	37	231
Nagaland	—	—	—	—	3	—	3
Orissa	1	3	8	22	25	3	62
Punjab	5	12	35	40	54	43	189
Rajasthan	6	4	23	52	51	9	145
Uttar Pradesh	17	18	56	81	79	16	267
West Bengal	12	19	46	35	50	12	184
Union Territories							
Andaman & Nicobar Islands	—	—	—	1	—	—	1
Delhi	2	—	1	—	—	—	3
Goa, Daman & Diu	—	—	1	1	4	7	13
Himachal Pradesh	—	—	—	2	4	7	13
Manipur	—	1	—	—	—	—	1
Pondicherry	—	—	2	1	2	—	5
Tripura	—	1	—	1	4	—	6

(Source: India Yearbook, 1967)

STATE/UNION TERRITORY-WISE DISTRIBUTION OF VILLAGES ACCORDING TO POPULATION (1961)

State/Union Territory	10,000 and over	5,000 to 9,999	2,000 to 4,999	1,000 to 1,999	500 to 999	Less than 500	Total
INDIA*	**776**	**3,421**	**26,565**	**65,377**	**1,19,086**	**3,51,650**	**5,66,878**
States							
Andhra Pradesh ..	28	458	3,918	6,050	5,834	10,796	27,084
Assam	—	13	398	1,999	5,041	20,699	30,153**
Bihar	44	441	3,339	7,635	13,784	42,422	67,665
Gujarat	7	141	1,332	3,301	5,229	8,504	18,584
Jammu and Kashmir ..	—	5	114	528	1,320	4,592	6,559
Kerala	510	587	395	57	18	6	1,573
Madhya Pradesh..	—	28	787	3,811	12,795	52,993	70,414
Madras	96	449	3,539	4,771	3,216	2,053	14,124
Maharashtra ..	29	305	2,215	5,958	10,235	17,109	35,851
Mysore	—	172	1,432	3,723	6,481	14,569	26,377
Nagaland ..	—	—	11	65	157	581	814
Orissa	—	16	452	2,513	7,334	36,151	46,466
Punjab	12	142	1,440	3,470	5,337	10,868	21,269
Rajasthan ..	—	94	1,003	2,936	65,96	21,612	32,241
Uttar Pradesh ..	23	308	3,795	12,801	26,015	69,682	1,12,624
West Bengal ..	25	244	2,156	5,224	8,514	22,291	38,454†
Union Territories							
Andaman & Nicobar Islands ..	—	—	—	2	20	337	399
Dadra and Nagar Haveli	—	—	3	18	23	28	72
Delhi	—	—	42	59	99	76	276
Goa, Daman & Diu	2	13	83	80	46	21	245
Himachal Pradesh	—	—	2	44	266	10,126	10,438††
L. M. & A. Islands	—	—	6	2	1	1	10
Manipur . ..	—	2	51	126	200	1,487	1,866
Pondicherry ..	—	3	21	62	89	213	388
Tripura	—	—	31	142	366	4,393	4,932

(Source: India Yearbook, 1967)

TOWNS AND VILLAGES ELECTRIFIED

Population range			Total number	Number electrified by March 31			
				1951	1956	1961	1966
Over 100,000	..	..	73	49	73	73	73
50,000 to 100,000		..	111	88	111	111	111
10,000 to 50,000	..	..	1,257	500	716	1,099	1,257
Below 10,000	..	..	5,72,750	3,677	10,245	26,878	53,385
Total	..	..	5,74,191	4,314	11,145	28,161	54,826

(Source: India Yearbook, 1967)

LITERACY IN INDIA**

State/Union Territory	LITERATES			PERCENTAGE OF LITERACY		
	Persons	Males	Females	Persons	Males	Females
INDIA	10,35,25,997	7,79,46,274	2,75,79,723	24.0	34.5	13.0
States						
Andhra Pradesh	76,26,527	54,82,333	21,44,194	21.2	30.2	12.0
Assam	32,48,055	23,61,724	8,86,331	27.4	37.3	16.0
Bihar	85,47,845	69,50,967	15,96,878	18.4	29.8	6.9
Gujarat.. ..	62,83,256	43,73,373	19,09,883	30.5	41.1	19.1
Jammu & Kashmir	3,92,761	3,21,827	70,934	11.0	17.0	4.3
Kerala	79,19,220	45,96,265	33,22,955	46.8	55.0	38.9
Madhya Pradesh	55,44,862	44,81,454	10,63,408	17.1	27.0	6.7
Madras	1,05,80,616	75,32,323	30,48,293	31.4	44.5	18.2
Maharashtra..	1,17,93,070	85,88,657	32,04,413	29.8	42.0	16.8
Mysore	59,90,585	43,52,428	16,38,157	25.4	36.1	14.2
Nagaland.. ..	66,117	45,917	20,200	17.9	24.0	11.3
Orissa	38,01,245	30,42,004	9,59,241	21.7	34.7	8.6
Punjab	49,17,396	35,91,177	13,26,219	24.2	33.0	14.1
Rajasthan ..	30,65,568	25,04,983	5,60,585	15.2	23.7	5.8
Uttar Pradesh ..	1,30,13,183	1,05,46,795	24,66,388	17.6	27.3	7.0
West Bengal ..	1,02,25,664	74,54,006	27,71,658	29.3	40.1	17.0
Union Territories and Other Areas						
Andaman and Nicobar Islands ..	21,372	16,675	4,697	33.6	42.4	19.3
Delhi	14,02,298	9,04,801	4,97,497	52.7	60.8	42.5
Himachal Pradesh	2,31,664	1,91,139	40,525	17.1	27.2	6.2
Laccadive, Minicoy and Aminidivi Islands	5,610	4,273	1,337	23.3	35.8	11.0
Tripura	2,31,188	1,75,060	56,128	20.2	29.6	10.2
Manipur	2,37,276	1,74,656	62,620	30.4	45.1	15.9
Dadra and Nagar Haveli ..	5,495	4,342	1,153	9.5	14.7	4.1
Goa, Daman & Diu	1,92,716	1,18,811	74,605	30.75	39.04	23.02
NEFA	24,260	21,879	2,381	7.2	12.3	1.5
Pondicherry ...	1,38,149	92,384	45,765	37.4	50.4	24.6
Sikkim	19,999	16,721	3,278	12.3	19.6	4.3

*Relates to pre-reorganisation

**Figures based on 1961 Census.

(Source: India Yearbook, 1967)

BUDGET AT A GLANCE

(Figures in Crores of Rupees)

	Revised Estimates for 1967-68	***Budget, 1968-69***
Revenue receipts	2,571.90	2,728.49
Revenue expenditure	2,484.81	2,622.57
Capital receipts	1,727.69	1,656.97
Capital expenditure	2,114.78	2,077.89
Total receipts	4,299.59	4,385.46
Total expenditure	4,599.59	4,700.46
Overall deficit	300.00	315.00*

(Source: Hindustan Yearbook, 1968)

NATIONAL INCOME

NATIONAL AND PER CAPITA INCOME

	National Income (Rupees billion)		*Per capita Income (Rupees)*	
	At current prices	*At 1948-49 prices*	*At current prices*	*At 1948-49 prices*
1948-49	86.5	86.5	249.6	249.6
1949-50	90.1	88.2	256.0	250.6
1950-51	95.3	88.5	266.5	247.5
1955-56	99.8	104.8	255.0	267.8
1956-57	113.1	110.0	283.3	275.6
1957-58	113.9	108.9	279.6	267.3
1958-59	126.0	116.5	303.0	280.1
1959-60	129.5	118.6	304.8	279.2
1960-61	141.4	127.3	325.7	293.2
1961-62	148.0	130.6	333.6	294.3
1962-63	154.0	133.1	339.4	293.4
1963-64	172.1	139.7	370.9	301.1
1964-65*	200.1	150.5	421.5	317.0
1965-66*	n.a.	144.9	n.a.	298.3

(Source: Hindustan Yearbook, 1968)

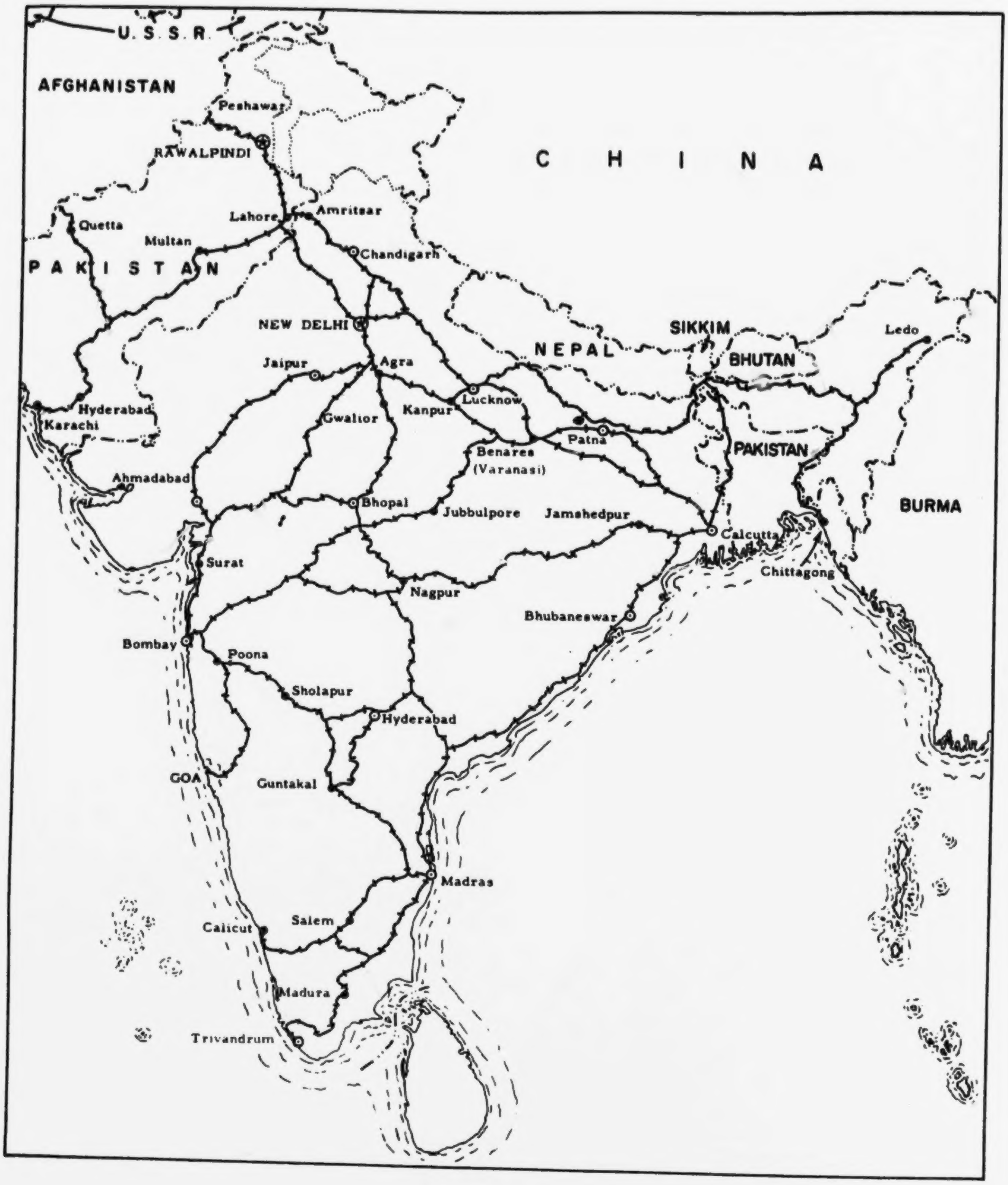
BROADCAST RECEIVER LICENCES IN FORCE

(as on December 31, 1966)

	Name of Circle	Domestic	Concessional				Com-mercial	Demons-tration	Dealers	Other Licences	Total
			Cheap radio sets	Com-munity	School	Hospital					
1.	Andhra	3,97,204	26,674	12,097	2,151	115	7,480	335	1,269	50	4,47,375
2.	Assam*	89,061	1,605	1,943	471	16	1,609	185	353	1	95,244
3	Bihar	2,10,771	19,527	1,518	1,342	28	4,181	310	789	20	2,38,486
4.	Delhi**	3,19,261	70,550	15	68	—	5,461	220	2,082	216	3,97,873
5.	Gujarat	5,04,596	20,454	9,367	792	65	9,224	389	2,078	71	5,47,036
6.	Jammu & Kashmir	51,325	6,674	1,992	87	1	804	134	156	5	61,178
7.	Kerala	1,43,898	4,538	3,605	1,255	17	5,178	138	693	11	1,57,333
8.	Madras	5,48,295	25,751	14,208	2,559	97	14,671	673	2,245	133	6,08,632
9.	Mysore	2,84,180	14,087	5,394	756	18	7,516	291	1,072	83	3,13,397
10.	Maharashtra	8,72,123	24,992	16,596	1,443	119	18,600	591	3,268	313	9,38,045
11.	Madhya Pradesh	2,45,121	18,183	5,334	599	116	5,753	300	985	81	2,76,472
12.	Orissa	76,407	11,328	3,190	2,403	90	1,527	546	461	46	95,998
13.	Punjab*	4,82,249	94,413	7,875	1,176	91	11,412	483	1,937	82	5,99,718
14.	Rajasthan	1,58,182	15,489	1,785	972	71	5,762	346	711	43	1,83,361
15.	Uttar Pradesh	5,17,777	95,387	10,380	2,330	129	10,560	176	2,626	23	6,39,388
16.	West Bengal	4,13,093	3,56,178	1,099	748	56	7,502	199	3,347	138	8,82,360
	TOTAL	54,13,543	8,05,830	96,398	19,152***	1,029	1,17,240	5,316	24,072	1,316	64,83,896

* Assam circle covers Assam, Manipur, Tripura, Nagaland & NEFA. Punjab circle comprises Punjab, Haryana and Himachal Pradesh.
** Includes Army Post Office.
*** Provisional figures.

(Source: India Yearbook, 1967)



Railroad system of India.

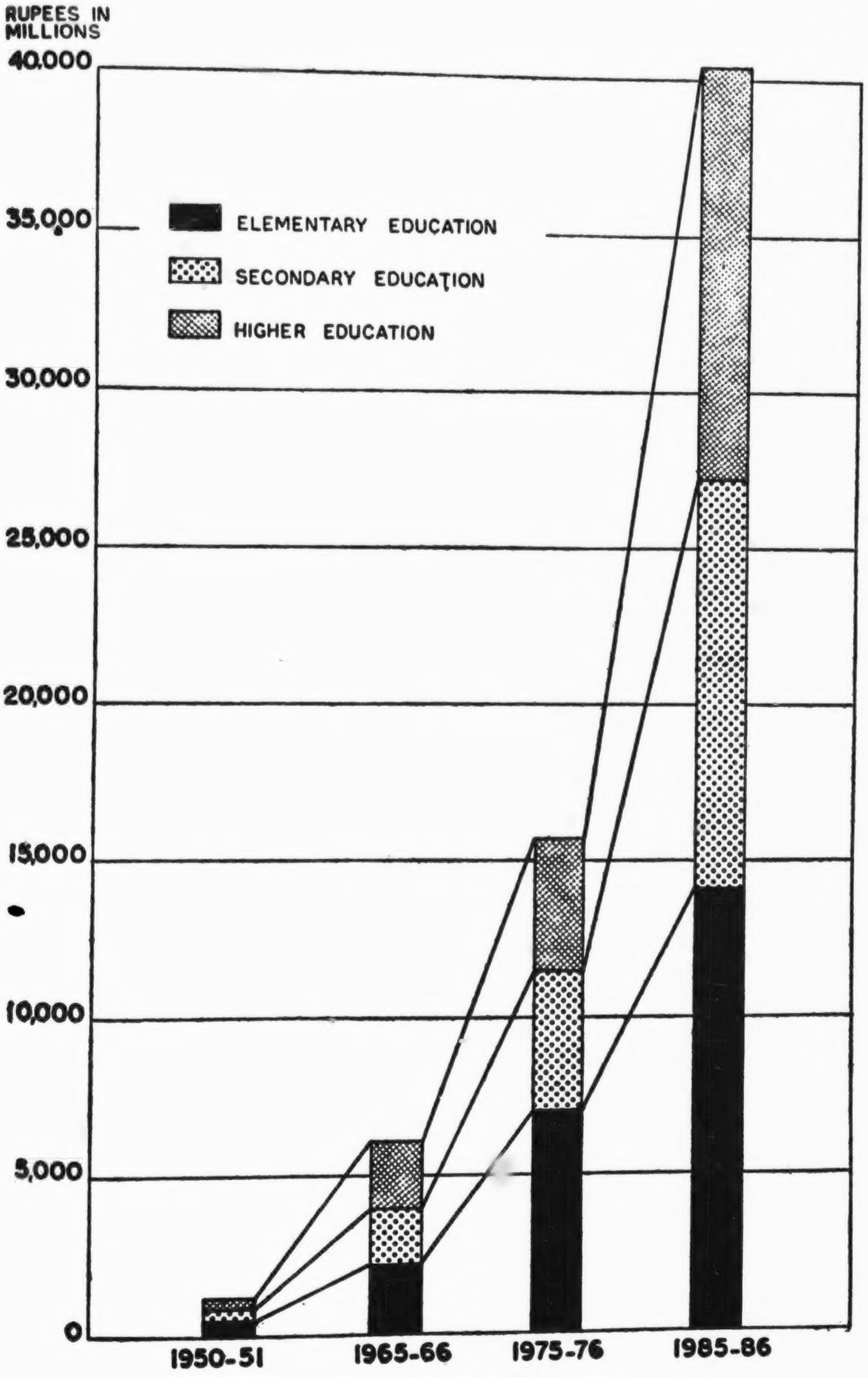
Source: The Army Handbook, 1964

INSTITUTIONS, STUDENTS, TEACHERS AND EXPENDITURE

Year	Number of institutions	Number of students on rolls	Number of teachers (lakhs)	Direct expenditure (Rs. crores)	Indirect expenditure (Rs. crores)	Total-expenditure (Rs. crores)
1950-51	2,86,860	2,55.43	8.04	91.05	23.33	114.38
1955-56	3,66,641	3,39.24	11.07	144.81	44.85	189.66
1960-61	4,72,655	4,79.63	15.08	257.36	87.02	344.38
1961-62	6,85,602	5,42.81	16.43	293.32	103.04	396.36
1962-63	7,26,632	5,79,77	17.59	332.13	109.62	441.75
1963-64	6,94,181	6,02,29	18.74	363.58	113.76	477.34

(Source: India Yearbook, 1967)

EXPENDITURE ON EDUCATION, BY LEVELS
1950-85



(Source: Report of the Education Commission, 1966)

TABLE 4.2. NUMBER AND PERCENTAGE OF TRAINED TEACHERS IN THE STATES (1965-66)

Name of State	Total number of teachers and percentage		
	Secondary stage	Higher primary stage	Lower primary stage
1. Andhra Pradesh .	34,215 (82.4)	15,625 (80.5)	86,501 (90.0)
2. Assam. . .	9,210 (18.6)	14,810 (22.4)	37,500 (55.0)
3. Bihar . . .	24,398 (50.2)	32,918 (72.5)	99,663 (82.7)
4. Gujarat . .	22,290 (66.4)	83,640 (61.4)	Included under higher primary
5. Jammu & Kashmir	4,613 a (25.6)	3,467 a (54.2)	4,874 a (54.0)
6. Kerala . .	22,031 (89.0)	39,406 (82.7)	59,703 (93.0)
7. Madhya Pradesh .	19,7006 (69.0)	27,961 b (72.0)	67,9096 (80.0)
8. Madras c . .	48,194 b (86.3)	59,440 b (93.1)	76,638 b (96.7)
9. Maharashtra .	48,590 (71.4)	151,500 (74.8)	Included under higher primary
10. Mysore . .	10,334 (59.5)	91,952 (59.9)	Included under higher primary
11. Nagaland . .	309 (15.9)	745 (8.7)	1,764 (20.3)
12. Orissa. . .	8,461 b (52.0)	10,322 b (31.0)	48,339 b (60.0)
13. Punjab . .	26,234 b (96.0)	14,911 b (88.0)	34,863 b (89·0)
14. Rajasthan . .	12,671 b (60.0)	18,352 b (71.0)	41,600 (75.0)
15. Uttar Pradesh .	33,311 (81.9)	46,819 (87.1)	162,472 (73.5)
16. West Bengal d .	40,238 (35.6)	12,041 (16.3)	98,306 (38.3)

Source. Furnished by Directors of Education.

N.B. Figures in parentheses indicate the percentages of trained teachers.

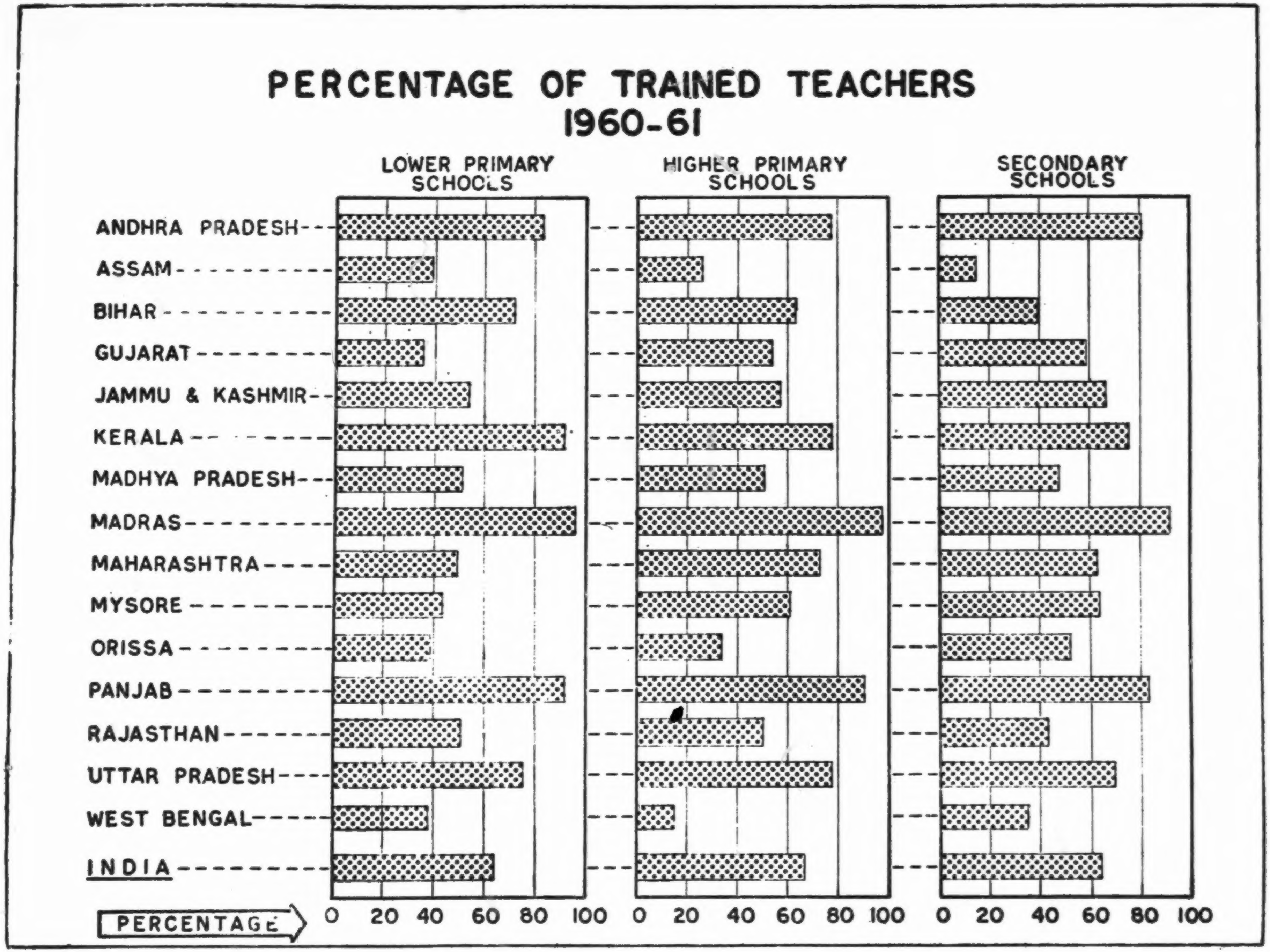
a. Figures relate to 1961-62. Taken from the memoranda of the State Government to the Education Commission.

b. Figures are estimated.

c. Figures relate to 1964-65.

d. Figures relate to 1963-64.

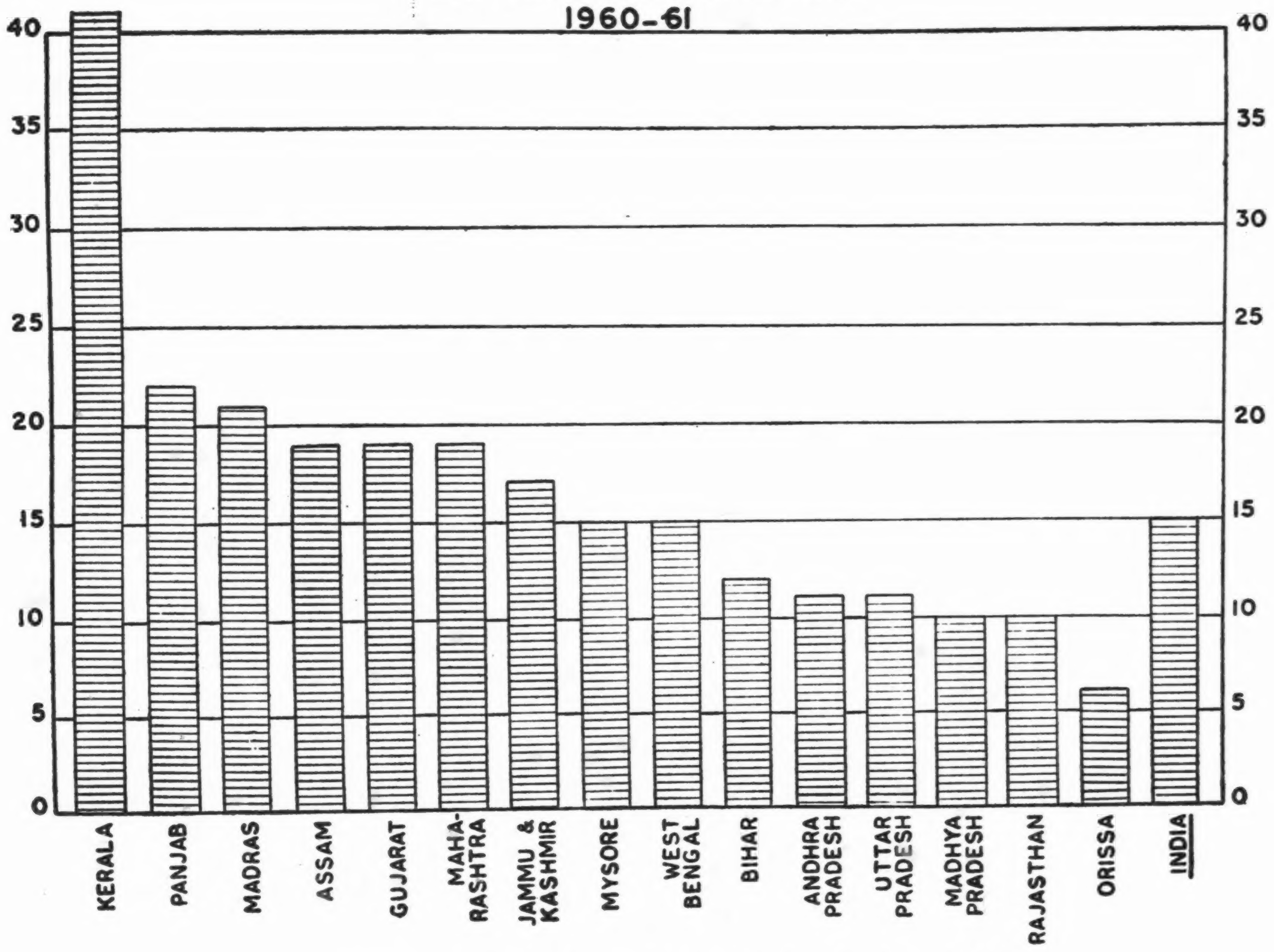
(Source: Report of the Education Commission, 1966)



PERCENTAGE OF TRAINED TEACHERS
1960-61

(Source: Report of the Education Commission, 1966)

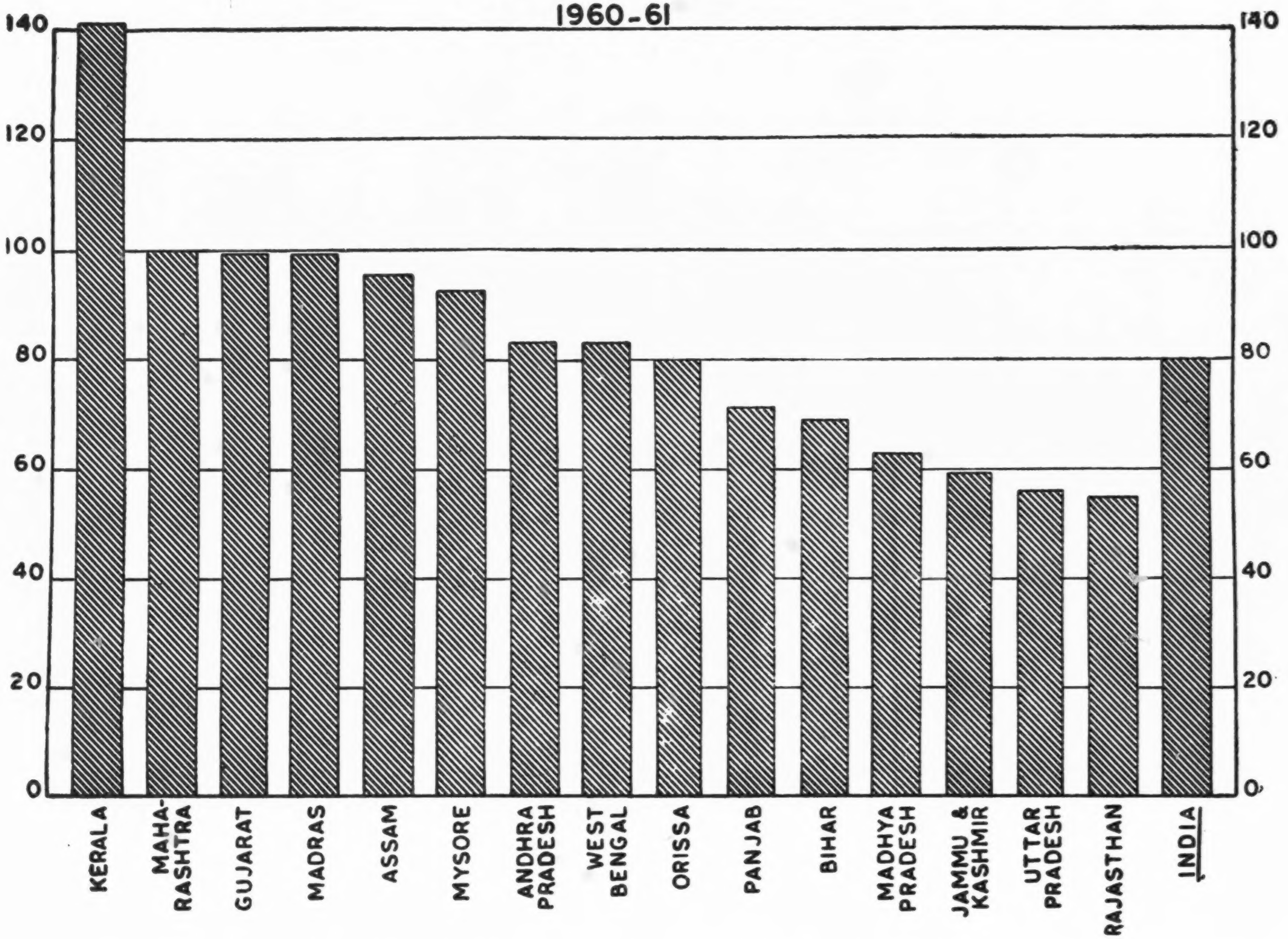
ENROLMENT AT HIGHER PRIMARY STAGE (CLASSES VI-VIII)
PER THOUSAND POPULATION
1960-61



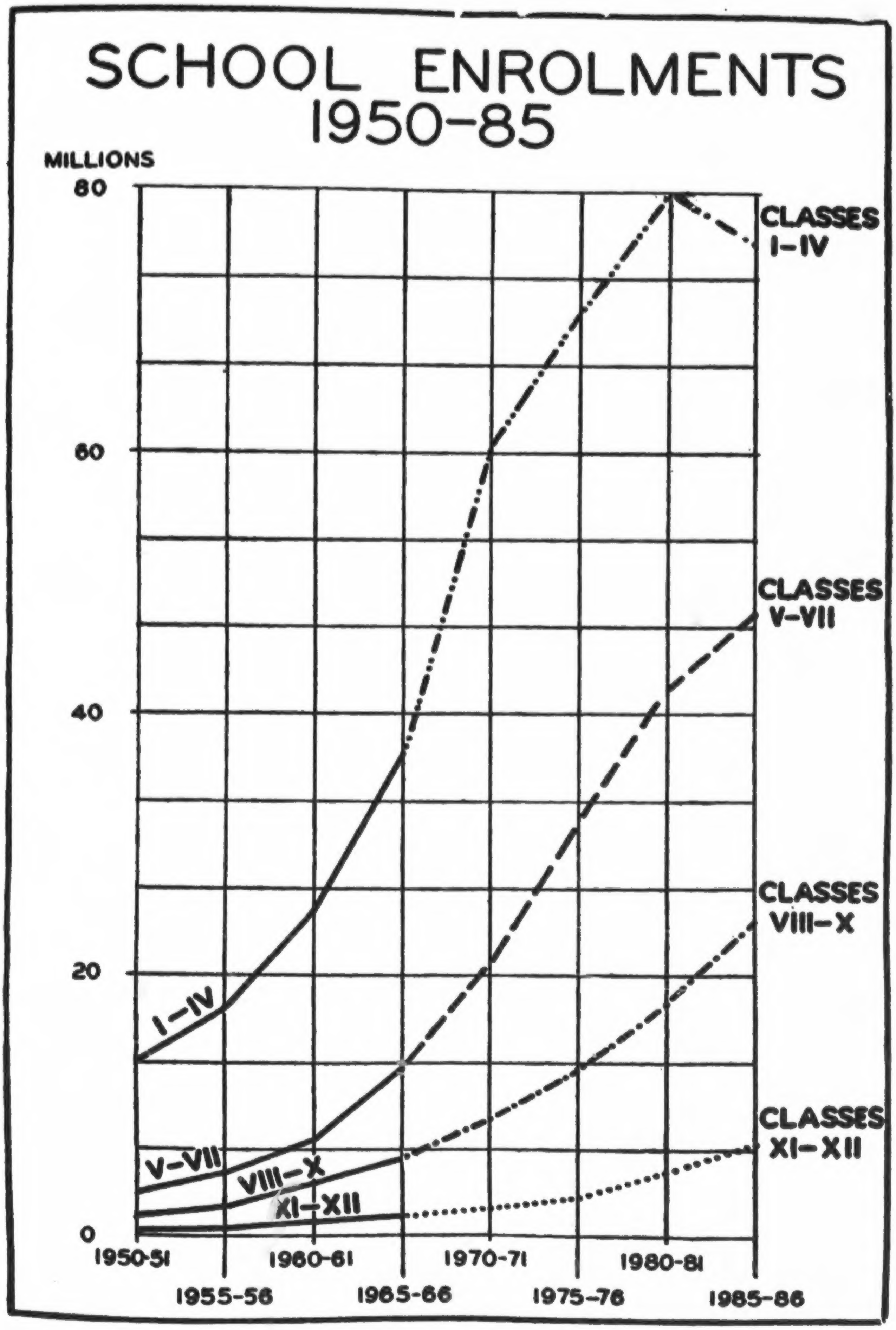
(Source: Report of the Education Commission, 1966)

ENROLMENT AT LOWER PRIMARY STAGE (CLASSES I-V) PER THOUSAND POPULATION

1960-61



(Source: Report of the Education Commission, 1966)



SCHOOL ENROLMENTS 1950-85

(Source: Report of the Education Commission, 1966)

AVERAGE ANNUAL SALARIES OF TEACHERS IN INDIA
(1950-51 to 1965-66)

Type of institutions	Average annual salary of teachers (at current prices) in				Average annual salary in 1965-66 at 1950-51 prices
	1950-51	1955-56	1960-61	1965-66	
A. Higher Education					
1. University departments	3,759 (100)	5,456 (145)	5,475 (146)	6,500 (173)	3,939 (105)
2. Colleges of arts and science	2,696 (100)	3,070 (114)	3,659 (136)	4.000 (148)	2,424 (90)
3. Professional colleges	3,948 (100)	3,861 (98)	4,237 (107)	6,410 (162)	3,885 (98
B. Schools					
4. Secondary schools	1,258 (100)	1,427 (113)	1,681 (134)	1,959 (156)	1,187 (94)
5. Higher primary schools	682 (100)	809 (119)	1,058 (155)	1,228 (180)	741 (109)
6. Lower primary schools	545 (100)	652 (120)	873 (160)	1,046 (192)	634 (116)
7. Pre-primary schools	914 (100)	770 (84)	925 (101)	1,083 (118)	(656) (72)
8. Vocational schools	1,705 (100)	1,569 (92)	2,041 (120)	2,887 (169)	1,750 (103)
ALL TEACHERS	769 (100)	919 (120)	1,218 (158)	1,476 (192)	895 (116)
9. Cost of living index for working classes	100	95	123	165	
10. National income per head of population (at current prices)	267 (100)	255 (96)	326 (122)	424 (159)	

Source. Ministry of Education, Form A. The figures for 1965-66 are estimates made in the Commission Secretariat.

N.B. The figures within brackets give the index of growth on the basis of 1950-51 =100.

DISTRIBUTION OF TEACHERS IN LOWER PRIMARY SCHOOLS/SECTIONS ACCORDING TO THE NUMBER OF PUPILS THEY TEACH (1965)

State	Percentage of teachers teaching pupils								
	Below 10	11—19	20—29	30—39	40—49	50—59	60—69	70 and above	TOTAL
	%	%	%	%	%	%	%	%	%
Andhra Pradesh	0·4	6·3	18·5	24·3	21·9	12·5	6·3	9·8	100·0
Kerala	0·2	1·9	31·7	30·8	11·8	4·2	3·4	16·0	100·0
Madhya Pradesh	3·6	14·0	23·8	23·9	15·5	7·9	4·2	7·1	100·0
Mysore	0·7	4·7	13·3	21·5	21·8	13·5	7·7	16·8	100·0
Orissa	1·7	10·4	17·9	30·0	20·1	9·8	4·9	5·2	100·0
Punjab	0·2	2·6	10·1	27·3	28·4	18·2	8·4	4·8	100·0
Rajasthan	1·0	7·0	16·6	17·1	11·7	9·2	6·2	31·2	100·0
Uttar Pradesh	1·0	6·5	15·1	20·6	19·9	13·9	8·8	14·2	100·0
ALL-INDIA	0·9	6·1	18·7	23·8	18·6	11·1	6·5	14·3	100·0

(Source: Report of the Education Commission, 1966)

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